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HARVARD COLLEGE

VOL. LIII

CAMBRIDGE, MASS., U. S. A.
Printed for the Museum
1936

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Memoirs of the Museum of Comparative Zoölogy
AT HARVARD COLLEGE
Vol. LIII

REPORTS ON THE SCIENTIFIC RESULTS OF DREDGING OPERATIONS FROM 1877 TO 1880, IN CHARGE OF ALEXANDER AGASSIZ, MADE BY THE UNITED STATES COAST SURVEY STEAMER "BLAKE," LIEUT. COMMANDER C. D. SIGSBEE, U.S.N., AND COMMANDER J. R. BARTLETT, U.S.N., COMMANDING, INCLUDING ALSO THE RESULTS OF THE DREDGING OPERATIONS FROM 1867 TO 1879, IN CHARGE OF L. F. DE POURTALÈS AND L. AGASSIZ, MADE BY THE UNITED STATES COAST SURVEY STEAMERS "CORWIN," "BIBB," AND "HASSLER," ACTING-MASTER R. PLATT, LIEUT. COMMANDER P. R. JOHNSON, U.S.N., COMMANDING.

XLIX

THE ALCYONARIA OF THE WESTERN PART OF THE ATLANTIC OCEAN

By ELISABETH DEICHMANN

WITH THIRTY-SEVEN PLATES

CAMBRIDGE, U. S. A.
Printed for the Museum
1936

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EDITORIAL FOREWORD

As far back as the Annual Report for 1898–1899 this Museum announced as "in preparation" a report by Prof. A. E. Verrill on the Blake Alcyonarians. Work on this report progressed steadily at Yale University, and pertinent specimens from this collection were sent to New Haven from time to time. The report began to assume larger and larger proportions because Prof. Verrill apparently planned a monographic treatment, to include a review of most of the described forms from the entire world.

Prof. Verrill died in 1927, and the writers assumed responsibility for the publications of the Museum in November of the same year. We found a manuscript of tremendous length, with a very large number of proposed new species, and a long series of heliotype and some colored plates illustrating these new forms. A very brief inspection of the manuscript showed that he must have quit working on it prior to 1911, as all references to literature ceased after 1910, and it was at once obvious that the manuscript was seriously out of date. Moreover, in many cases the types of proposed new species and other material cited proved to be missing from the museum's collections.

Needless to state, the services of a specialist were absolutely essential in such a state of affairs. Miss Elisabeth Deichmann was given a Fellowship early in 1928 "to make an attempt to collate the manuscript, plates and type specimens upon which Dr. Verrill based his report . . . . . No one untrained in methods of marine zoological taxonomy would be competent to undertake this herculean task, for both the manuscript and collection are at present in sad confusion. Whether it will ever be worth while to publish this report remains to be seen" (extract from Director's report for 1927–28, p. 8).

The answer, unfortunately, has proved to be that it was not worth while. The present volume is a new report by Miss Deichmann, that retains scarcely a single line of Professor Verrill's. Miss Deichmann has completed her revision according to the recent monographic treatments of Kükenthal and Broch and Hickson. She has, of course, used the names which Verrill selected when possible, and has many times had occasion to acknowledge the use which she has made of Dr. Verrill's notes.

We are unable to give the history of this manuscript from 1910–1927, nor do we know what work if any Professor Verrill may have done on it during this

period. But we know that the systematic history of any group of animals can be roughly divided into two stages (1) the preliminary, proposing an increasing number of genera and species based on whatever characters are first and most readily observed and (2) a later stage, with a sounder basic classification, which involves the discarding of many proposed genera and species, based on growth stages, habitat differences or even individual variations. Professor Verrill was a great leader in the first stage in the study of the Alcyonarians, the extensive literature appearing after 1911 has ushered in the second stage. The chances are that the lapse of another decade or two will see the reduction of more dubious West Indian species to synonymy than the description of additional novelties.

Be this as it may, the present report is strictly confined to the region represented by the Museum's collections from the Western Atlantic, and all other species are omitted. Only eleven of the original 140 plates proved serviceable in the present connection. These have been mostly skillfully renumbered by the Heliotype Company of Jamaica Plain, Mass., who have also erased the erroneous names of most of these plates, printing over the erasures the new and correct names of the corals figured. These remarks should consequently explain the appearance of the plates and their apparent departure from the style normally adopted in our Memoir series.

Dr. Verrill was a student of Professor Louis Agassiz and a life long friend of his son Alexander, and by ties of traditional esteem and affection was bound to this institution, in which he was an officer from 1860–1864. It is with the deepest regret indeed that this Memoir could not appear under his own name.

T. Barbour and L. Griscom

I. INTRODUCTION

When Professor Verrill died in 1927 he left a manuscript of great length, describing the Alcyonarians secured between 1867 and 1880 by the "Blake" and other deep-sea expeditions in the West Indian seas and off the east coast of the United States. It was evident from the numerous references to Indo-Pacific forms that he intended to make a critical study of the entire group. As the Alcyonarians have been treated in several extensive monographs during the last twenty years, large parts of Verrill's manuscript had become completely out of date; he had apparently made no use of the literature on the subject since 1911–12. It has therefore been necessary to adopt the latest taxonomic arrangements. Very often they are almost the same as those employed by Verrill. The references to Indo-Pacific forms have been omitted, since other authors have made the corrections suggested. The descriptions have been re-written and re-arranged according to modern principles, and a number of genera and species, which Verrill considered new, have been abandoned, because they were based upon differences which are now not regarded of taxonomic importance. On the other hand, the paper has been extended to include all species occurring in West Indian waters,[1] off the coast of Brazil, and off the east coast of North America (except for one family).[2] The older collections in the Museum of Comparative Zoölogy contain many of the types and specimens used by Verrill in making his determinations and also some West Indian material from the collections of Duchassaing & Michelotti, as well as from those of Kölliker. It was thus

[1] Very few references are made to the occurrence of Alcyonarians in Bermuda. Only the most spectacular shallow water forms have been collected, mostly Plexaurids which are not included in this paper. Verrill, 1907, describes five common forms and 12 Plexaurids. More systematic collecting along the shores will undoubtedly reveal that the fauna is much richer than Verrill's list leads one to suspect and also dredging may be expected to give interesting results. Only a few dredgings were made by the "Challenger," and the few species secured were described by Wright & Studer in 1889.

[2] The family Plexauridae is represented in the West Indian seas by five genera with numerous species, mostly shallow water forms. A single species was obtained by the "Blake" Expedition from deeper water. Most of the genera have been treated extensively by Kunze (1916), others briefly by Moser (1921), and the whole family is included in Kükenthal's Gorgonacea (1924). As the Museum of Comparative Zoölogy possesses relatively few colonies, most of which are quite common forms, not yielding additional information, it seemed useless to translate Kunze's and Kükenthal's results. A key to the five genera is given, and references are made to Kükenthal's, Kunze's and Moser's papers.

possible to correct many of the mistakes in Kükenthal's and his students' papers on West Indian forms, which were based partly upon a study of the literature, partly upon Kükenthal's and Hartmeyer's own collections, and partly upon specimens which Kükenthal had obtained during his visit to Harvard in 1911.

The West Indian Seas were fairly well explored in early times, even the deeper sea. The present study therefore adds relatively few new species to science. But the "Blake" material and the collections in the Museum of Comparative Zoölogy give a very complete picture of the composition of the fauna, a picture which has been lacking hitherto because so many of the forms were insufficiently described and hence were of doubtful validity.

In connection with the revision of the collections in the Museum of Comparative Zoölogy, I have had the opportunity of examining the material used by Verrill, in the Victoria Memorial Museum, Ottawa, for his last publication in 1922, and also the large collections of Alcyonacea collected off the west coast of the United States, belonging to the United States National Museum, Washington, while a visit to the British Museum in July, 1934, enabled me to examine numerous types and species not well represented in American museums. I offer my sincere thanks to Dr. R. M. Anderson, Dr. Waldo Schmitt and Capt. A. K. Tottom for their generous help and for permission to publish on the material in their charge. I am also especially indebted to Dr. Sydney J. Hickson of Cambridge, England, with whom I have corresponded and who has kindly looked over some parts of the manuscript. Out of his lifelong experience he has given invaluable corrections and suggestions.

Material

The material examined for Verrill's manuscript was originally the collection secured by the "Blake" Expedition in 1877–1880 (about 600 lots), which was referred first to L. F. de Pourtalès. He died in 1880 without having started the work. When the report was almost ready for publication in 1910, it was decided that Verrill should include the material collected by Pourtalès and Stimpson ("Bibb" and "Bache," 1867–1872), which had been returned undetermined from Kölliker (about 200 lots). The material from A. Agassiz's dredgings along the coast of New England in 1880 (partly published in 1883), and the "Hassler" material (from 1871–1872, L. Agassiz), was also included.

About 580 separate dredgings were made in West Indian waters, and in 186 of the localities Alcyonarians were brought to the surface. In rocky places several species were found in one haul; in muddy localities only a few. The

absence of deep-water Alcyonarians may be due in many cases to the fact that only ordinary dredges were used instead of tangles, and it is greatly to be recommended that both types of instruments be used to secure this kind of material. The use of a dredge explains why Pourtalès acquired so many of the small soft forms of the orders Alcyonacea and Telestacea, and only fragments of the larger more robust forms such as those belonging to the families Muriceidae and Gorgonellidae, which were so numerous later in A. Agassiz's hauls with tangles in the same localities.

Several specimens secured by Stimpson in 1872 in the waters around Florida, during dredging operations by the "Bache," have no station number and often no record of depth. The number of actual dredgings is therefore somewhat higher than the lists (p. 286) beyond indicate.

In the present revision of Verrill's manuscript all the material in the Museum of Comparative Zoölogy which could be of any interest has been included. Such common forms as Rhipidogorgia, etc., which have been recently monographed, are simply mentioned and a reference given, while in those cases where the material shows new features, or re-establishes a doubtful species, it is fully discussed. In many cases the dredgings from deeper water contained relatives of forms which are mostly shallow water species, and it thus became necessary to give a short revision of the whole genus. In this way the paper has been naturally extended to include all the shallow water forms with the exception of the Plexauridae.

Composition of the Fauna

About 200 valid species are known from the West Indian region and from the waters off the east coast of North America and Brazil. About 145 of these have been previously recorded, though several doubtfully, so there are now added about 50 previously unlisted species, some of which seem to be identical with the deep water forms in the eastern Atlantic. A large number of doubtful species have been found to be valid; others are regarded as synonyms, while a few have been completely discarded (Kükenthal, 1919, gives a fairly complete list of all the doubtful Gorgonacea). A total of about 125 species have been examined; of these about 100 are in the "Blake" collections and the others in the old collections in the Museum of Comparative Zoölogy. Very few additions to the West Indian Alcyonaria are to be expected in the future. Those that are found will consist mostly of species already known from deep water in the eastern Atlantic.

Although our knowledge of the number of existing species is fairly satisfactory, there are still gaps in the data covering these forms to be filled. There are large parts of the West Indian area where no collections have ever been made of shallow water gorgonians, and there are also large parts of the deeper water which have never been dredged and which undoubtedly would yield interesting results. We know for example about how many Pennatulacea there are in this region, but they are known only from single specimens because too few dredgings have been made in muddy localities. The "Blake" collections contain unexcelled series of several species, illustrating the changes which these forms undergo during growth, and they also contain evidences of individual variations, but there are other forms which are known only from fragments. Many fragments are in such an imperfect condition that it has been impossible to give a general description of the outer shape or size which the colony normally reaches.

The Relationship of the Fauna to that of Other Waters

I. The shallow water fauna consists of a West Indian and a Brazilian element. There is no shallow water fauna peculiar to the Atlantic coast of North America. A few species from Florida are still common off the coast of North Carolina and a single species may even occur in dredgings off New York, but that is rather an exceptional case.

A striking feature of the shallow water fauna in the West Indian and in the Brazilian region is the absence of Alcyonacea, a peculiarity which these two areas seem to have in common with the rest of the tropical Atlantic as well as with the Pacific coast of Central America. This condition is in marked contrast to the Indo-Pacific area, where cushionlike, spinous, or tree-shaped Alcyonacea are among the most characteristic forms.

The Brazilian and West Indian faunas seem in the main to be distinctly separate. One species of *Leptogorgia*, two species of *Renilla*, and one of *Stylatula* are apparently identical in the two areas, but the remainder, with the exception of certain Plexauridae, appear to be different. The Brazilian fauna is much poorer in species than the West Indian. Whether it originally came from the West Indies or whether it is chiefly derived from African sources is at present impossible to tell, but probably the latter will be found to be the case.

It is not known with certainty how many of the west Atlantic species actually occur in the tropical eastern Atlantic. None of the east Atlantic or Mediterranean species in the Museum of Comparative Zoölogy are identical

with any of the western forms in the collection. The Stolonifera and Alcyonacea are furthermore not too well known. A single species of Telesto, however, is known from the west coast of Africa and may be identical with one of the west Atlantic forms. The shallow water Gorgonacea are richly developed in the West Indian and Brazilian waters, while few species are known from the eastern part of the Atlantic. Most species are distinctly different, but the descriptions given by Bielschowsky (1929) of certain species of west African *Leptogorgia* make it seem likely that one or two species occur on both sides of the Atlantic. Her description of *L. petechizans,* for example, suggests very much the West Indian *L. sanguinolenta,* and her *L. purpurea* may be the same as the one listed here as *L. purpurea* from Brazil. From what we know about the extension of range of some stony corals it is quite possible that a few hardy species from South Africa may have reached the West Indian or Brazilian coasts and become settled there. Originally these few species may have come from the Indo-Pacific Ocean (see Thiel, 1928). There are only a few shallow water Pennatulacea in both the eastern and western Atlantic and they all appear to be different; the American forms belong to genera which are strictly limited to American waters.

The fauna found off the west coast of Central America seems entirely different, with the exception of two species of *Renilla* and one of *Stylatula* (?), which extend their range around the southern end of South America. Bielschowsky lists one species of *Leptogorgia, L. rubra* nom. nov., as recorded from Brazil, from the Straits of Magellan, and from the west coasts of Central America and California, but she has undoubtedly united two or three species under the one name. At least all the west coast species of *Leptogorgia,* which I have examined, are different from the Brazilian species (*L. purpurea* Esper of the present paper).

II. The lists which follow show that the Stolonifera and Alcyonacea of the deeper water are mostly the same in the eastern and the western parts of the Atlantic. A few forms are still known only from American waters, but it is possible that they are identical with some less well known deep water forms from the eastern Atlantic.

The Telestacea, well represented in American shallow waters, have, aside from Verrill's form from the coast of Africa, one deep water form known off the shores of the Azores, which may be expected in American waters.

From the descriptions, the bulk of the Gorgonacea of the deeper water seem to be the same on both sides of the Atlantic, but material from the two sides has never been compared or studied by persons who had the same conception of

the limits of the species and genera. A few genera, such as *Thesea*[1], seem, however, to be developed only in West Indian waters.

A single species of the family Gorgoniidae seems to be common in deep water in both areas, although most of the members of this family occur in very shallow water. The Gorgonellidae, chiefly regarded as a shallow water family, occur in the Atlantic Ocean almost exclusively at a depth of more than 100 fathoms. A few species have been listed from the West Indies as well as from the Azores and South Africa by Toeplitz (1928), but it is doubtful whether any of them have so wide a distribution. Most of them seem to be characteristic either of the West Indies or of the eastern Atlantic region. It has been known for a long time that the Chrysogorgiidae and the Primnoidae, as well as the Isididae, are represented both in the eastern and in the western part of the Atlantic by the same species. The "Blake" material has confirmed this fact. It is noteworthy, however, that one of the genera known from shallow water (56 fms.) off the Cape of Good Hope occurs also in the West Indies, and is represented, as far as can be ascertained, by the same species.

The Pennatulacea from deeper water seem to be practically the same in both the eastern and the western Atlantic. Some of them are reported also from the Indo-Pacific. One of the two listed species of *Umbellula* is reported by Studer off the west coast of Panama, but his material has not been compared with the "Blake" specimens[2]; undoubtedly he was wrong.

History of the West Indian Alcyonarians

Among first descriptions of West Indian Alcyonarians were Pallas' (1766) and several of his species were later figured by Esper (1788–97). From 1792 to 1860 we have scattered descriptions or merely lists of names of West Indian corals compiled by Ellis & Solander, Milne-Edwards, Lamarck, and Valenciennes. In the middle of the last century it was thought that the precious coral might possibly exist in the West Indies, and a number of dredgings were made by Italians, but with negative results. They provided material, however, for Duchassaing & Michelotti's classical monographs on the West Indian corals. Between 1860 and 1907 there were a number of short descriptions of West Indian

[1] Hickson's *T. crosslandi* from Panama (1928, p. 354) seems to be another species and genus. The type of *T. guadalupensis*, as well as the other West Indian forms, have no projecting outer spines on the spicules.

[2] Hickson (1928, pp. 334–336) has studied the shallow water fauna from Panama, and compares it with the West Indian forms.

species, as well as of forms occurring off the east coast of America, by Pourtalès and especially by Verrill.

In 1901 Hargitt & Rogers published a paper on the Alcyonarians from Porto Rico, with a brief outline of the genera which were known at that time in West Indian waters. From 1908–1929 a number of small detailed papers dealing with West Indian corals were published by Kükenthal and his students. They were based upon the material from Kükenthal's and Hartmeyer's expedition, consisting mostly of shallow water forms, and upon various specimens taken by the "Blake," etc., which Kükenthal obtained while staying at Harvard. In 1912 Verrill published a paper on the Brazilian Alcyonarians (not mentioned in any of Kükenthal's or his students' papers), and in 1922 he published a paper on North American Alcyonarians. A few forms from Curacao were described by Gordon in 1925. Aurivillius in 1931 added some new West Indian species, and redescribed one old form, from Brazil. Kükenthal and Broch's Pennatulacea (1911) and Kükenthal's Gorgonaria (1919), in the "Valdivia" report, gave an extensive bibliography, including the literature on the West Indian forms. In Kükenthal's Pennatularia (1915) and Gorgonaria (1924) in "Das Tierreich," all species which can be recognized are listed, with short descriptions and complete lists of references. Large parts of these two papers are based, however, exclusively on the study of the literature, and invaluable as they have been in the preparation of this paper, they contain many errors, which have been corrected in all cases where specimens have been available in the Museum of Comparative Zoölogy.

Kölliker included a few American Pennatulacea in his large monograph of 1872 and in the "Challenger" report of 1880; Wright & Studer also gave descriptions of several West Atlantic Alcyonarians in their report of 1889.

When one examines the literature listed in Kükenthal's recent papers, one is surprised at the small amount of work that has been done on the shallow water fauna of the Mediterranean Sea and on that of the west coast of Africa, the Canaries, etc. Since v.Koch's time there are only scattered descriptions (Lacaze-Duthier and others), but no comprehensive studies with consideration of the relationship of the various species. The deep water forms have been treated in the Monaco reports by Studer (1901) and Thomson (1927), and these authors include also the species described by the older authors. In addition there have been Roule's report from the Gulf of Gascogne (1905) and Stephens' paper on the fauna of the Irish waters (1910). The northern forms have been treated by Broch (1911, 1928), Jungersen (1904, 1927), and Molander (1915, 1918, 1929),

all of whom have done their share in reducing the number of doubtful species, and by their critical studies have put our knowledge of this difficult group on a more solid basis.

Taxonomic Arrangement

The taxonomic arrangement which follows is based on the brief outline by Hickson (1930). Regarding the Pennatulacea and Gorgonacea, the sequence used by Hickson (1916) Kükenthal and Broch (1911), and Kükenthal, (1915, 1919, 1924) has been followed as closely as possible; a repetition of the literature has thus been avoided in most cases by giving references to their papers. The remaining orders which Kükenthal (1925) has grouped together in the subclass Alcyonaria, on account of the long gastral cavities which he thinks are present in all of them, are here kept separate following Hickson's arrangement. A few have been placed in the Gorgonacea.

The attempt has been made to list all recognized species from the West Indian, Brazilian, and eastern United States waters. Brief references are also made to most deep sea forms which have been taken in the eastern Atlantic, as many of them undoubtedly occur likewise in the western part, or are represented by very closely related forms. Thanks to the works of Kükenthal (1907–1925), Kükenthal and Broch (1911), and Laackmann (1908), it has been easy to do this in the case of the Pennatulacea, of the Gorgonacea, and of the Telestacea. It has been more difficult in the case of the Stolonifera and of the Alcyonacea where no single person has ever had all the material in hand. Molander's paper on the northern forms of Alcyonacea (including Stolonifera) has been used as the foundation for the list of these forms, supplemented by Broch's paper on the northern species of *Eunephthya* (1928), but in the case of the Clavulariidae and to some extent in the Alcyoniidae the lists do not claim to be complete, as no material has been available in most cases, and the descriptions and conceptions of species and genera of the different authors are so contradictory, that it is impossible to untangle the threads with the help of literature alone. The literature has been studied as carefully as possible, and it is hoped that the lists are now fairly complete, and that no species appears twice, under different names, or has been completely lost. Molander's last paper (1929) has unfortunately not been available.

The arrangement which Verrill used in his manuscript differed in no essential features from Hickson's or Kükenthal's outlines; the Pennatulacea were, however, placed first and the Stolonifera last. It was obviously necessary to change this

order. Several new families that had been established were abandoned, and the genus *Riisea* was placed in the Gorgonellidae instead of the Chrysogorgiidae. The changes which have been made in the taxonomic arrangement have, therefore, not been of a fundamental nature and are only such as Verrill himself would have probably made had he had the opportunity to see the more recent studies of Hickson and Kükenthal. It must be remembered that their results are, in many cases, founded upon his earlier studies.

Characters Used for Determination

The fact that large parts of the collections have been preserved dry or in a strongly contracted condition in alcohol has made it necessary to leave out all finer anatomical and histological details. The characters which have been used in the descriptions have therefore been only the most simple, namely, 1) macroscopical features such as size, outer shape, and branching of the colony, its axis and color, the arrangement, size, and armature of the zooids, the structure of the coenenchyma; and 2) microscopical features, namely, the spicules and their arrangement.

I. Macroscopical Features

In the Stolonifera the size of the colonies seems to be somewhat limited; they rarely extend more than 2 cm. in length and breadth, even small colonies showing the characteristic features. The zooids are large compared to the thin coenenchyma. Their arrangement in clusters or singly is generally assumed to be a constant specific character. The color in most deep water forms is white or grey; in the shallow water forms it is often bright red or yellow and quite variable (*Sarcodictyon*).

In the Telestacea the stolons give rise to a large number of tall upright primary zooids, often forming grass-like coverings, where the outer conditions are favorable. The primary zooids may reach a height of 20 cm. in some species, whereas other forms are consistently shorter. The arrangement of the secondary zooids on the primary zooids and their relative sizes are matters of taxonomic importance. The longitudinal striation of the walls and the color seem to be constant features in this small order.

A few of the tropical shallow water Alcyonacea form enormous, low colonies but mostly the lump-shaped forms are less than 10 cm. in extent. The branched forms seem to have very definite limits in the height to which they grow, perhaps

due to mechanical reasons. Even the simplest forms appear to conform to a definite outer shape. Strong contraction and poor preservation of the colonies in the course of time have often caused much misinterpretation, as Broch's work on the northern species of *Eunephthya* has revealed, especially when poor preservation of the material has been combined with an inadequate study of the spicules on the part of the investigator. As a rule one can say that the outer shape is a valuable distinguishing character in the Alcyonacea. Where no dimorphism occurs, the shape and size of the zooids are almost constant within a species. In the dimorphic species the autozooids increase in size and number with advancing age, apparently until a certain limit is reached. Nothing is known about the longevity of these forms.

The shallow water Gorgonacea in the West Indies usually grow to a height of between 50–100 cm. or even more. Very few are shorter (*Briareum asbestinum*, *Muricea spicifera*). Among the deep water forms there are certain families which have small delicate colonies, rarely more than 20 cm. in height (Muriceidae, Chrysogorgiidae, Gorgoniidae, certain Isididae) while others normally reach 100 cm. or more (most of the Gorgonellidae, Primnoidae, certain Isididae). We know from observations made in the Tortugas Laboratory, that most of the shallow water forms reach their maximum size in 3–5 years and after that period they remain practically constant. Very young specimens are often less easily recognized, because they have not yet developed the typical branching. Fortunately the structure of the colony is very much the same in every part, and conclusions based on a study of either a fragment of a large colony or of a small juvenile colony are therefore valid. The thickness of the branchlets is almost constant throughout the life of the colony and they furnish valuable characters in identifying species, while the stem varies in thickness with age and has a variable amount of zooids and often a less characteristic spiculation. The size of the zooids is in most cases constant, even in the few forms which have dimorphism, and if considered in connection with the thickness of the branchlets, they furnish valuable outer characters. In the lowest forms within most of the families the number of zooids is large and undefined, while the zooids themselves are usually almost completely retractile and have very little characteristic armature of spicules. In the higher forms they are more scattered, sometimes definitely arranged into pairs or into whorls containing a constant number; the armature of the zooids becomes more specialized, and they are often unable to retract. The shallow water forms all have numerous zooids either completely retractile (Gorgoniidae) or forming short simple tubes (Plexauridae), sometimes with a

strongly pronounced operculum (Muriceidae). The deep water forms often have strongly spinous zooids, with long projecting needles (Acanthogorgiidae, Isididae), or zooids resembling flowers of cacti. In many cases new zooids are intercalated between the older; in other more specialized forms the number is settled from the beginning and additional zooids develop from the tip of the branchlets. In the whip-shaped forms of Gorgonellidae the zooids in the upper part of the colony are often several mm. smaller than those below. The spicules then become the most important criterion, as a broken tip has often been referred to different species from the lower part, when the size of the individual zooid is alone used as the distinguishing character!

The coenenchyma shows a specialization similar to that of the zooids. The more primitive forms have a thick coenenchymatic layer with numerous spicules, while the higher forms have a thin layer either with specialized spicules or almost free from them (Isididae, certain Chrysogorgiidae).

The structure of the axis forms an important character in many cases. In the Scleraxonia the axis consists of spicules and a horny substance poorly set off from the outer tissue in the more primitive forms, but sharply set off in others, as in the precious coral where it forms a stone-like substance. An alternation of horny substance and horn and spicules is found in some of the east Asiatic forms. With the exception of certain species of *Corallium*, *Paragorgia*, the Melitodidae, etc., most Scleraxonia form relatively small colonies. Among the Holaxonia some families have an axis which distinguishes them from the other families. The hard metallic axis of the Chrysogorgiidae, with its often peculiar mode of branching, the jointed horny and calcareous axis of the Isididae, and the stone-like axis with concentrically arranged layers of the Gorgonellidae, are important features. In the remaining families, the axis shows certain variations, sometimes resembling horn, sometimes resembling wood with peculiar spaces between the layers ("gefächert," Kükenthal; "loculated," Hickson). Kükenthal has tried to use this character for distinguishing the latter families, but without success. Most Muriceidae have a loculated, wood-like axis, but in *Muricea* itself, the axis is almost pure brown and horn-like; most of the species of the Gorgoniidae have a horny axis while others have it loculated.

The Gorgonacea are either attached to the sea bottom by a smaller or larger horny disk covered with coenenchyma (in the more primitive forms with zooids, in the more specialized barren), or they have short rootlets which may be attached to stones, but usually, anchor the colony in the mud (Chrysogorgiidae, Isididae). Some of the most primitive of the Scleraxonia (*Briareum* and others)

have creeping stolons, and either form simple colonies covering the marine substratum (*Erythropodium*) or give rise to several simple stems.

In some Gorgonacea the color is a valuable character, in others it is quite variable. The species of *Muricea* which occur in Panama, are easily separated by their color, whereas such forms as *Leptogorgia setacea* and *virgulata* in the West Indies and off the coast of North America vary from pale yellow to ochre, or deep red, or red and yellow mixed. From some localities white, pink, and red specimens of *Scleracis* have been brought up in one haul of the dredge.

In the Pennatulacea the shorter, broad forms, such as *Renilla* and *Pennatula*, have rather definite size and proportions and also a fairly constant number of different kinds of zooids, according to age, but in the rod-shaped forms, such as *Stylatula*, new rows seem to be added almost indefinitely, not from the tip but from an area between the stalk and the rachis. These forms may sometimes reach a length of 200 cm. (in the Pacific Ocean) while the short broad forms rarely grow higher than 20 cm. Polymorphism is strongly pronounced in this order, and as the juvenile stages have only few zooids, new ones developing toward the ventral side (except in the forms where complete rows are added from the basis of the rachis), the result is that the young colony is entirely unlike the adult, and consequently many errors have been made in analysing these forms. There is actually very little in the outer shape to indicate that one has an immature specimen before one. The question has been solved only by painstaking comparisons of all available specimens in large collections. The armature of the zooids and the relation between the stalk and the rachis have often proved to be valuable characters. The axis, which is present in almost all forms, sometimes offers valuable points, being either round or squarish in the different species, etc. The color is a constant character in most cases, and is found in the spicules themselves. A few cases of albinos among normally colored specimens have been recorded (*Pennatula, Renilla*).

II. Microscopical Features

In the most primitive group, Stolonifera, the spicules are either simple spindles or shorter bodies, sometimes star-shaped or cross-shaped, evidently derived from capstans. There is very little difference between the spicules of the coenenchyma and those of the zooids. In some species they may show a definite arrangement in collaret and operculum. The highly specialized and isolated Telestacea have long or short rods with few projections. In the older part of the

primary zooids they are often interlocked to form a close, solid meshwork. In the Alcyonacea the spicules are either derived from capstans or are simple spindles, sometimes both kinds occurring in the same species, sometimes only one. The zooids have little armature, but an operculum and collaret may sometimes be present. In the order Gorgonacea the greatest diversity of spicules is found, in many cases showing a similar development from the more simple to the more complicated. In the lowest of the Scleraxonia the spicules are simple, being almost smooth in the axis, while in the outer layer they are either thick, warted spindles or short, cross-or star-shaped bodies with tufts of warts, somewhat resembling those found in certain Stolonifera but much more regular. The zooids have little or no armature; that which does occur differing only slightly from that of the coenenchyma. The operculum has, at the most, only a few simple flat rods. In the Gorgoniidae the zooids are usually completely retractile and have practically no spicules in the upper part. The spicules of the thick coenenchyma are belted, warted rods; in some forms the rods are curved in the outer layer, while in others the confluent warts of some spindles are reduced to narrow disks. In the Plexauridae there is a tendency toward the formation of an outer layer of more club-shaped spindles, often with the spines better developed on one side, or even developed as plates or leaves; one genus has innumerable flask-shaped spicules. The zooids of the family are numerous and often not quite retractile, their spicules differing little from those of the thick coenenchyma. There are few or no spicules in the operculum.

In the heterogeneous family Muriceidae the coenenchyma is mostly thin and divided into an outer and an inner layer with different kinds of deposits. The zooids are never completely retractile, — at least the conical or eggshaped operculum projects a little over the surface, and in most cases the zooids have spicules which differ markedly from those found in the coenenchyma. The shape of the spicules varies from simple spindles, often occurring with capstans, to heavy plates, thin plates, pseudo-spindles, and crosses or plates with peculiar outer comb-like projections, etc. They vary in size from several mm. down to about 1/10 of a mm.

The small family Acanthogorgiidae has slender needle-like spicules arranged in zigzag rows and often projecting. The tentacles are strongly spiculated, but no regular operculum is present.

In the Gorgonellidae double rods and heads, mostly with closely packed warts, occur together with more or less flattened capstans. The spicules are of the same kind in the coenenchyma and in the zooids and their tentacles, but the

relative length and breadth of the spicules may be different in different parts. The double rods and heads are most numerous in the outer layer and the capstans in the inner, but the extremely small size of the spicules and the large number in which they occur makes it difficult to separate these different layers. The spicules in the Chrysogorgiidae are either simple warted spindles, or they resemble those found in the Gorgonellidae, but they are thinner and more plate-like. In one genus, *Riisea*, they resemble exactly those in the Gorgonellidae.

The highest development of spicules is found in the Primnoidae where they form large, thin scales on the stem and branches, mostly in one layer. In the large non-retractile zooids they are arranged in more or less definite order and number, those in the lower part often being different from those in the upper part. A well developed operculum is present with few but large, leaf-like plates.

In the Isididae the spicules are either thin plates, somewhat resembling those in the Primnoiidae, but much smaller, or they are long slender needles, often several mm. in length.

The Pennatulacea have simple needles almost exclusively. They are often three-flanged, or the lower end is expanded like the head of a clumsy nail. They occur in more or less constant arrangement, often in fan-like clusters, and with a definite relationship as to size in the different parts of the colony. They may be very large, even to the point of being visible to the naked eye. Minute miliary grains are often characteristic of the axis. A few forms have short rods or plates.

Technical Terms

Macroscopical Features

anthocodia: the distal free part of the zooid bearing the mouth and tentacles.

anthostele: the proximal rigid part of the zooid.

autozooids: individuals with a complete circle of tentacles, and mesenteries; used in forms with di- or trimorphism, where incomplete smaller siphonozooids also occur; corresponds to *polyp* used in older literature.

axis: the central part of the colony in the Gorgonacea, whether horny, or consisting of spicules and horny substance; also the central calcareous rod which occurs in most Pennatulacea.

calyx or *calicle:* the basal part of the anthocodia (Molander); also used to designate the verruca.

coenenchyma: the living tissue which connects the individual zooids and contains the soleniae or nutritive canals.

collaret: a ring of transversely placed, bow-shaped spindles below the tentacles.

crown: the same as collaret.

dorsal, and *ventral* side: the side of the axial zooid which carries the ciliated groove (the sulcus) and where new zooids may develop, is called the ventral side, while the opposite or asulcar side is called the dorsal. Used only in the Pennatulacea. "Front" and "back" side used in Gorgonacea with fan-shaped colonies, when the zooids are gathered more densely on one side than on the other.

leaves: lateral folds upon the axial zooids in some Pennatulacea, upon which the rows of secondary zooids are arranged.

loculated: condition of the structure of the axis in some Gorgonacea, when spaces occur between the horny layers.

operculum: the spicula-filled tentacle bases.

pinnulae: lateral folds in the tentacles.

points: the eight divisions of the operculum.

rachis: the upper part of the axial zooid, including all the secondary zooids; used in the Pennatulacea.

siphonozooid: reduced individual either without tentacles or with only rudimentary ones; has a large siphonoglyph, and only the two dorsal mesenteric filaments; occurs in some Alcyonacea, in a few Gorgonacea, and in all Pennatulacea; corresponds to *zooid* as used in older literature.

solenia: tubules extending from the gastral cavity and connecting the individual zooids; from these, new zooids may sprout.

stalk: the sterile part of the primary zooid in Pennatulacea, which rests in the mud.

stolon: band-like or plate-like outgrowths from which new zooids or compounds of zooids may arise. Occurs in the Stolonifera, in the Telestacea, and in a few of the most primitive Gorgonacea.

sulcar, asulcar: ventral, and dorsal side in the Pennatulacea.

verruca: in the Gorgonacea; used for the contracted zooid.

wings: the folds (pinnae) or leaves, upon which the secondary zooids are borne in some Pennatulacea.

zooid: the individual animal, regardless of its anatomical features; introduced instead of the older term "polyp" by Bourne.

Microscopical Features

Most of the terms used in describing the spicules are easily understood; only a few, therefore, need explanation.

capstans: short, blunt-ended deposits with narrow middle and from three to four thickenings around the ends, sometimes more flattened. Some modified spicules seem to be derived from capstans. They occur mostly in the deeper layers of the tissue.

clubs: deposits derived from spindles (or capstans?) with one end thickened, and often with larger development of spindles, warts, leaves, etc.

disk-carrying spindles: belted spindles in which the belts of warts have developed into confluent sharp ridges; occur in the inner layer of some Gorgoniidae.

double rods, double spindles and *double heads:* usually symmetrically developed deposits with narrow smooth middle and crowded clusters of warts toward the ends; the heads are almost circular in outline, while the rods and spindles are elongate and either blunt or pointed; the deposits are sometimes flattened; typical of the Gorgonellidae.

pseudospindles: deposits derived from capstans through strong development of one side; they are often V-shaped but may also completely resemble a simple primary spindle.

scaphoids: halfmoon-shaped, belted spindles, often with warts and spindles suppressed on the convex side; occur in the outer layer of some Gorgoniidae.

thorn scales: flattened scale-like deposits with a strong projecting outer spine or thorn; arranged like petals in the zooids of many genera of the Muriceidae.

II. SYSTEMATIC ACCOUNT[1]

Key to the orders of Alcyonaria occurring in the Atlantic Ocean

1. Free-living colonies with a rounded stalk, the lower end of which is buried in the soft sea bottom, and with a short or long rachis which carries the zooids. The zooids are frequently of more than one kind and are often bilaterally arranged..V. *Pennatulacea* p. 253.
1. Attached colonies without stalk and rachis, forming a sheet-like covering, irregular fleshy lumps or elegantly branched forms with or without axis; with or without dimorphism..2.
2. Colonies mostly branching, tree-like, rarely sheet-like; with horny axis or at least horny substance in the central part. Gastral cavities short ..... IV. *Gorgonacea* p. 72.
2. Colonies without horny axis or horny substance in the central part; if present it is as a lining of the gastral cavity or the outer surface. Gastral cavities long .....3.
3. Fleshy or hard, lump-formed to branched forms; spicules as rods, as belted spindles with composite warts, as grains, or as lamellate bodies; never fused. Dimorphism often present ..... III. *Alcyonacea*[2] p. 46.
3. Tubular, branched, or simple forms with creeping bandlike or sheet-like stolons. Wall of zooids often firm, with spicules wedged together. No dimorphism.....4.
4. Tubular primary zooids with secondary zooids (i.e., those sprouting from the side of the walls; sometimes also tertiary, etc. zooids). Horny lining of gastral cavity, often also on the outside of zooids ..... II. *Telestacea* p. 39.
4. Simple zooids, not branching from side of primary zooid. Mostly simple spindles with scattered simple warts. In *Tubipora* the wall is rigid with complicated spicules .....
I. *Stolonifera* p. 31.

Order I. Stolonifera Hickson 1894, emended 1930

Plate 1, figs. 1, 3–4; Plate 2, figs. 1–22

Diagnosis: — Alcyonarians with membranous or ribbon-like stolon not exceeding 6 mm. in thickness; zooids connected with one another by endodermal canals at the base only, or in addition by connecting bars (*Clavularia viridis*), or by transverse platforms (*Tubipora*).

[1] The following abbreviations are used when referring to the museums whose collections contain the material discussed in this paper: Br.M., British Museum; M.C.Z., Museum of Comparative Zoölogy, Harvard College; V.M., Victoria Memorial Museum, Ottawa; U.S.N.M., United States National Museum, Washington, D. C.

[2] Molander (1915, p. 17) has critically studied a large number of forms with creeping stolons and he has found that *Alcyonium* and *Gersemia* may occasionally develop as creeping, flattened forms. He regards *Sympodium* as near to *Alcyonium*. In this paper it is placed in the *Xeniidae*, following Kükenthal, 1925, and Hickson, 1931.

Remarks: — A discussion of this difficult order is given by Hickson (1930, pp. 238–241). He recognizes three families, one of which is well represented in the Atlantic Ocean. A representative of one of the two other genera is described from the West Indies.

Key to the families

1. No spicules; colonies with a thin, horny outer covering ..... *Cornulariidae*
1. Spicules usually present; no horny outer covering ..... 2.
2. Colonies forming rigid tubes in some forms connected by transverse platforms ..... II. *Tubiporidae.*
2. Colonies not forming rigid tubes connected by transverse platforms ..... I. *Clavulariidae.*

The first family is exclusively Mediterranean and Pacific. The Clavulariidae are well represented in the Atlantic Ocean. Hickson (1930) lists in all 14 genera, (some of which are not valid), two occurring in the Atlantic Ocean, only one of which is with certainty known from the American side. The Tubiporidae are chiefly Indo-Pacific forms, but one genus from West Indian waters is described in the following pages.

Family 1. CLAVULARIIDAE

Plate 1, fig. 1; Plate 2, figs. 5–8

Key to the genera known from the Atlantic Ocean

Spicules simple warted spindles not firmly wedged together .. 1. *Clavularia* Quoy & Gaimard.
Spicules short irregular rods, crosses, or stars, firmly wedged together in the stolon and lower part of the zooids ..... 2. *Sarcodictyon* Forbes.

List of Clavulariidae reported from the western part of the Atlantic

Clavularia modesta (Verrill)
C. rudis (Verrill)
C. tubaria Wright & Studer
? *C. bathybius* (Saville Kent)

Doubtful forms

Sarcodiclyon rubens (Verrill)
Sarcodiclyon rugosum Pourtalès

From the north eastern part of the Atlantic

Clavularia arctica Sars
C. stormi Koren & Danielssen

C. (*Anthelia*) *borealis* Koren & Danielssen
C. (*Anthelia*) *fallax* Broch
Sarcodictyon catenatum Forbes

From the eastern Atlantic
Anthelia armata Thomson
Clavularia armata Thomson
Clavularia bathybius (Saville Kent)
C. concreta Thomson, nec Studer
C. elongata Wright & Studer
Clavularia marioni v. Koch
C. tubaria Wright & Studer
Rhizoxenia rosea v. Koch
Sarcodictyon catenatum Forbes

Few of the species from the northeastern or eastern part of the Atlantic Ocean have been examined, and it is not possible to state the affinities nor the exact number of species. The most recent work on these forms is due to Molander (1915, 1929). Most likely the number of species can be reduced considerably. Thomson, 1927 gives no reference to Molander's work and his application of the generic names is not easy to follow. Molander (1915 and 1929) discusses some of the species. He retains *Anthelia* however.

The "Blake" secured one species from the West Indies. It is here referred to *C. bathybius* (Saville Kent) but may possibly be new. One species taken off Sombrero Island, West Indies, and three from the coast of New England, Nova Scotia, etc. have previously been listed. Some of these may be identical. *Clavularia riisei* Duch. & Michelotti from St. Thomas is placed in *Telesto*, in the next order.

1. Clavularia Quoy & Gaimard 1834

Diagnosis: — Stolonifera, with zooids large in comparison to the thin stolon. Spicules simple spinous spindles, rods, or clubs, occasionally double forms.

Type species: — *Clavularia viridis* Quoy & Gaimard.

Remarks: — At present this genus includes *Trachythela* and *Cornulariella* Verrill, *Anthelia* Savigny, *Gymnosarca* Saville Kent. *Anthopodium* Verrill (1872c, p. 434) from South Carolina may belong to this genus or to *Sarcodictyon*. Hickson

(1894, p. 385) gives a fairly complete list of the species which appear to belong to this genus, and a list of Clavulariidae reported from the western part of the Atlantic.

Key to the species of Clavularia known from American waters

1. Body of zooid low; large collaret and high operculum; spicules as spindles with scattered spines, and up to 0.7 mm. long ..... 3. ? *C. bathybius* (Saville Kent).
1. Body of zooid high; none or very poorly developed operculum; spicules often blunt or club-shaped rods ..... 2.
2. Spicules large, up to 1.25 mm. ..... 4. *C. rudis* (Verrill).
2. Spicules about 0.30–0.45 mm. in length ..... 3.
3. Stolons forming reticulums ..... 2. *C. tubaria* Wright & Studer.
3. Stolons not forming reticulums ..... 1. *C. modesta* (Verrill).

1. Clavularia modesta (Verrill)

Cornulariella modesta Verrill, 1874, p. 40, pl. 8, figs. 1–2; 1922, p. 38, pl. 6, figs. 5–6, text figs. 8–9 (complete list of references).

? *Clavularia concreta* Studer, 1901, p. 15, pl. 1, figs. 1–2. Non *Clavularia concreta* Thomson, 1927, p. 7, pl. 1, fig. 14.

The present material shows only narrow stolons with stout eight-ribbed zooids having comparatively small tentacles, mostly completely withdrawn. The zooids are either scattered or crowded, the latter seeming to be the case when the colony is attached to a small object. The zooids may retract to low tubes but usually they are 10–17 mm. in height. The color varies from white to brownish.

The spicules are warted spindles, either pointed or blunt; the former kind predominates in the stolon and in the zooids, where they are arranged in converging double rows, the latter kind in the basal part of the tentacles. A few of the opercular spicules are transversely arranged, but a distinct collaret is not present. The spicules are 0.30 — 0.45 mm. in length. In the tentacles there are a number of much smaller blunt rods among the larger ones.

Type: — U.S.N.M., cat. no. 30145.

Type locality: — Off Head Harbor, Casco Bay, Maine, in 35 fms., on a mussel shell.

Distribution: — Off coast of New England, Newfoundland and Nova Scotia, mostly at depths of 20–35 fms., but occasionally at greater depths (220 fms., Whiteaves; 1267 m., Studer).

Specimens examined: — The type and 150 specimens from 82 different localities, all from shallow water (loaned from U.S.N.M.).

Remarks: — The most characteristic features of this species seem to be the tall body of the zooid, which is rarely much contracted, and the diminutive crown of tentacles. The measurements of the spicules and the outer appearance make it very likely that Studer's *Clavularia concreta* belongs to this species, although it came from an unusual depth. Unfortunately there are not sufficient data to permit a comparison of the different temperatures at which the specimens were taken. (Molander, 1915, p. 28, thinks *C. concreta* Studer does not belong in *Clavularia*).

Judging from Thomson's figure, his *C. concreta* from off Cape Verde, represents an entirely different species.

2. Clavularia tubaria Wright & Studer

Clavularia tubaria Wright & Studer, 1889, p. 256, pl. 42, fig. 10. — Studer, 1901, p. 14. — Thomson 1927, p. 7, pl. 4, fig. 5.

This species seems to be characterised by reticulated stolons with tall zooids having completely retractile tentacles and spicules developed partly as clubs or blunt rods with numerous tufted warts (according to Wright & Studer's figure).

Type: — In Br. M.

Type locality: — Off Sombrero Island, W. I., in 820 fms.

Distribution: — West Indies, and off the Azores and Madeira (Studer, Thomson).

Specimens examined: — None.

Remarks: — Possibly identical with *C. modesta*. The U.S.N.M. has a specimen from a depth of 33 fms., off Salem, Massachusetts, which exactly resembles the figure of *C. tubaria* given by Thomson (from about 700 fms. depth).

3. (?) Clavularia bathybius (Saville Kent)

Plate 1, fig. 1; Plate 2, figs. 5–8

? *Gymnosarca bathybius* Saville Kent, 1870, p. 397, pl. 21, figs. 1–4.
? *Clavularia elongata* Wright & Studer, 1889, p. 257, pl. 42, fig. 11.
? *Clavularia concreta* Thomson, 1927, p. 7, pl. 4, fig. 14.

The collection contains two colonies, which grew on dead gorgonians. One colony is 4 cm. in length with four zooids in a row on a narrow thin stolon; the other is about 3 cm. long and 1.5 cm. wide with six zooids arranged irregularly in two rows. The stolon forms a thin membranaceous plate filled with small spindles. The zooids are short and broad, indistinctly eight-ribbed, the marginal spicules

forming eight points. There is a broad collaret and a tall operculum with the spicules in double converging rows. The color is greyish brown.

The spicules consist of slender pointed spindles with a few scattered simple spines. The spicules are relatively small (up to 0.4 mm.) in the stolon, and increase in size in the zooid wall (up to 0.7 mm). In the collaret they are much smaller (about 0.3–0.4 mm.). They increase in size in the basal part of the tentacles and decrease toward the tips.

Type: — Probably in Br. M.

Type locality: — Of Cezimbra, Portugal, in 500 fms.

Distribution: — Eastern and western parts of the Atlantic Ocean in 500–700 fms.

Specimens examined: — Two colonies on dead gorgonian stems collected off Guadeloupe Island, W.I., in 734 fms. ("Blake" Sta. 173); M.C.Z. cat. no. 4078.

Remarks: — I have referred the present material to Saville Kent's species, because the colonies closely resemble his figures. He gives no measurements of the spicules. Thomson's *C. concreta* from the Azores also resembles the present material in the low body of the zooid, in the tall collaret and operculum, and in the thin broad membranous stolon. I do not think that it is the real *concreta*. Thomson says, moreover, that it does not agree with Studer's figure. *C. elongata* Wright & Studer, from the Azores, has spicules which seem to resemble those found in the present species. The main difference is that *C. bathybius* has the zooids in clusters, but that may be a character of absolutely no value.

4. Clavularia rudis (Verrill)

Trachythele rudis Verrill, 1922, p. 37, pl. 7, figs. 1–7.

The species is incompletely described. It seems to be characterized by its very large spicules, up to 1.25 mm. in length.

Type: — Apparently lost.

Type locality: — Off Newfoundland fishing banks, in deep water (no definite depth given), on dead *Ceratoisis* stems.

2. Sarcodictyon Forbes 1847

For discusssion of synonyms, number of species, etc. see Hickson, 1930, p. 209.

Diagnosis: — Stolonifera in which the colonies form creeping stolons. The walls of the stolons and the lower part of the zooids are stiffened by spicules which form short irregular rods, stars or crosses.

Type species: — *S. catenatum* Forbes.

Remarks: — In 1894 Hickson united this genus with *Clavularia,* but in 1930 he re-established it again, with *S. catenatum* Forbes as the type species, the only form known with certainty from the Atlantic Ocean. The genus is not positively known from the American side but two doubtful forms may prove they belong in this genus.

Sarcodictyon rugosum Pourtalès, 1868, p. 113, no figure. "Small polydom rising from creeping stolons, on pebbles. Like little knobs, fragile, rough, closed by the contraction of the polyp by means of about six irregular rough pieces meeting together. When opened, the cavity shows six or eight membranous septa, nearly meeting in the centre. Stolons covered by irregular calcareous pieces. Color dirty white. Diameter of polyps one tenth of an inch." The type came from off Havana, 270 fms, and it is doubtful whether it is an alcyonarian at all; it has not been found in the M.C.Z.

Anthopodium rubens gen. et spec. nov. Verrill, 1872b, p. 434. Described as an incrusting form. No figures are given but the description of the spicules as light red, glomerate, irregularly cross-shaped, etc. could apply to *Sarcodictyon.* The type is lost and the species has never been recovered. It came from Fort Macon, North Carolina and grows on dead Leptogorgia stems.

Family 2. TUBIPORIDAE

Plate 2, figs. 1–4

Diagnosis: — from Kükenthal, 1925, p. 712. The colony consists of long, fairly parallel, closely placed zooid-tubes, the upper ends of which usually form a rounded surface. The body wall contains small rods which are flattened and almost smooth, but toward the basal part they develop large isolated projections by means of which the rods gradually become wedged together. They then form a solid calcareous tube which increases in thickness toward the base. The stolons also have rigid calcareous walls, and fuse into horizontal plates or platforms. The new zooids sprout from the basal stolon and from the lateral platforms.

Remarks: — At present only one certain recent genus, *Tubipora,* is known, with a number of species not yet well defined (some authors list seven), and restricted to the Indo-Pacific and Red Sea. Another genus, *Cyathopodium,* is here provisionally placed in this family.

Duchassaing & Michelotti (1860, p. 35) report *T. musica* L. from the Antilles, but such an occurrence would seem to be impossible. Their specimen may be

identical with the small coral described below, the systematic position of which is still undecided.

The coral in question was taken off Barbados, and in his notes Verrill placed it in the Telestidae in the genus *Cyathopodium*. As type species he gives *C. tenue*, first described by Dana (1864, p. 630, pl. 59, fig. 5) from the Paumotu Islands in the South Pacific as *Aulopora*, and later referred to *Cyathopodium* gen. nov. by Verrill (1868a, p. 415). The form described here seems to have an intermediate place between *Clavularia* and *Tubipora* and may eventually be placed in a new family. But as long as we do not know whether the specimens which have been examined are full-grown or not, nothing definite can be said about *Cyathopodium's* position.

Species of Tubiporidae known from the western part of the Atlantic Ocean.

Cyathopodium elegans spec. nov.

Cyathopodium Verrill 1868

Cyathopodium Verrill, 1868a, p. 415.
? Aulopora Dana (part.), 1846, p. 630, pl. 59, fig. 5.

Diagnosis: — Clavularia-like forms with short tubular zooids, having well developed inner layer of horny meshwork and outer layer of spicules, firmly wedged together into a solid tube; zooids retractile into the tube which closes flatly with an operculum of warted spindles.

Type species: — *C. tenue* (Dana).

Remarks: — The structure of the upper part of the zooids in Dana's species is not known. Verrill says that the free part of the zooid in the specimen examined was worn off. Dana describes the tubes as being short and rigid like those in *Tubipora*. The spicules were not studied.

Cyathopodium elegans spec. nov.

Plate 2, figs. 1–4

The largest colony represents a number of slender stolons which cover profusely a small piece of coral rock. About seven short vertical tubes, 5 mm. high and about 0.70 mm. in diameter, sprout from the stolons. The colony is bright red and very rigid and brittle. The opening of the tubes is closed by a

kind of operculum of lemon-colored spicules. The tentacles are withdrawn halfway down into the tube. The tentacles in the only zooid which was studied contained a collaret of small simple yellow rods and 2–4 smaller rods, arranged en chevron, in the basal part of each tentacle. The tubes are wide and thin walled, with the usual eight longitudinal inner bands of a horny substance and, in addition, there is a pronounced inner coating of the same substance forming a thick mesh work. The spicules are closely packed and firmly united to each other and to the inner coating. When isolated they are found to consist of short, clumsy deposits with a number of composite warts. There is no outer layer of horn in any part of the present colonies. The outlines of the deposits are clearly visible with a binocular microscope.

Some of the isolated red spicules are 0.15 by 0.05 mm.; the spindles in the operculum may be as long as 0.25 mm.; the rods in the tentacles are 0.07 to 0.11 mm. in length.

Type: — M.C.Z. cat. no. 4231.

Type locality: — Off Barbados, in 81 fms. ("Blake" Sta. 293).

Distribution: — From the type locality and also, off Barbados, in 69 fms. (Sta. 248).

Remarks: — It is possible that the present species, which strikingly resembles a young *Tubipora*, is identical with the specimen which Duchassaing & Michelotti (1860, p. 35), listed as *Tubipora musica* L. from the Antilles. Apparently their record has been considered inaccurate and has therefore been ignored.

Order II. Telestacea Hickson 1930

Plate **1**, figs. 3–4; Plate **2**, figs. 9–22

Diagnosis: — Stoloniferous alcyonarians with secondary individuals arising from the lateral walls of the primary individuals. No soft tissue developed. Spicules in the wall of the individuals form branching rods, often fused in the older part of the colony. One family, Telestidae, with four genera.

Remarks: — Hickson 1930 elevates the family Telestidae to an order with one family. Three of the four genera are exclusively Indo-Pacific while the fourth, *Telesto*, seems to be predominatingly Atlantic, particularly West Indian, although a few forms are known also from the Indo-Pacific.

Family TELESTIDAE

Only one genus is known from the Atlantic Ocean.

Telesto Lamouroux 1821

For literature, synonyms, etc. see Laackmann (1908, pp. 41–104, pls. 2–8, text figs. A-H). Later, Kükenthal (1913), has given additional information.

Diagnosis: — Alcyonarians with reticulate stolons, axial and lateral zooids; upper part of zooid retractile into the lower part; axial and lateral zooids lined with horny substance which is thickened at the origin of the septa; spicules of the older part of the stem strengthened by horny substance; secondary zooids up to the 5th order.

Type species: — *T. riisei* (Duch. & Mich.).

Remarks: — Kükenthal (1913, pp. 234–235) lists seventeen species from tropical seas, mostly from shallow water and apparently of very narrow distribution. Three species were already known from the West Indian region, and two new species have been added by the "Blake" explorations. One species is rejected as insufficiently described (*T. corallina* Duchassaing, 1870, p. 19, possibly *Cyathopodium*).

Verrill (1870, p. 372, *T. africana;* not mentioned by Laackmann) has described one shallow water species from the west coast of Africa. It may possibly be a synonym of one of the species described in the following.

A deep water species has been reported off the Azores by Studer (1901) and is included in the key.

List of species of Telestidae, known from the western part of the Atlantic Ocean

Telesto flavula spec. nov.
T. fructiculosa Dana
T. riisei (Duchassaing & Michelotti)
T. rupicola (F. Muller)
T. sanguinea spec. nov.

From the eastern Atlantic

Telesto africana Verrill; (shallow water)
Telesto rigida Wright & Studer; (deep water)

Key to the species of Telesto which occur or may be expected in the West Indian region

1. Axial zooids about as long as the lateral zooids, without longitudinal furrows (?); colony low, only a few cm. high; deep-water form; color orange-red . . 1. *T. rigida* Wright & Studer.

1. Axial zooids long, compared to the lateral zooids, with longitudinal furrows; colony high (5–20 cm.); shallow water forms ..... 2.
2. Longitudinal furrows on the stem narrow ..... 3.
2. Longitudinal furrows on the stem broad ..... 5.
3. Spicules red ..... 2. *T. sanguinea* spec. nov.
3. Spicules yellow or colorless ..... 4.
4. Secondary zooids alternate, feather-like in arrangement; spicules colorless ..... 3. *T. flavula* spec. nov.
4. Secondary zooids irregularly distributed; spicules yellow ..... 4. *T. fructiculosa* Dana.
5. Spicules united in the upper part of the stem; few simple slender rods 0.45 mm. in length. 5. *T. riisei* (Duchassaing & Michelotti).
5. Spicules loose in the upper part of the stem; numerous long slender rods 0.72 mm. in length. 6. *T. rupicola* (F. Müller).

1. Telesto rigida Wright & Studer

Telesto rigida Wright & Studer 1889, p. 261, pl. 37, fig. 3; pl. 32, fig. 9. — Laackmann, 1908, p. 73, (all references).

? T. humilis Thomson, 1927, p. 55, pl. 4, figs. 1, 13; pl. 6, fig. 3.

Type: — In Br. M.

Distribution: — Off the Azores in 3062 m. ("Challenger"), and in 1000–3075 m. ("L'Hirondelle").

Remarks: — This species may be expected in the West Indies. It is possible that it is identical with Thomson's *T. humilis* from off the Azores, which, however, has distinct longitudinal furrows.

2. Telesto sanguinea spec. nov.

Plate 1, fig. 3; Plate 2, figs. 9–12

There are about twenty small colonies of this strikingly red species in the M.C.Z., all attached to bits of dead shell. The tallest colony measures about 3.5 cm. in height and has two stems. Other colonies have as many as six stems arising from a narrow stolon which is firmly attached to a small shell fragment. The axial zooid is clavate, usually 1 mm. wide at the base and 2 mm. wide at the top. It gives rise to a few obliquely placed secondary zooids which in turn may develop one or two tertiary zooids. The great uniformity in the size of the colonies, all of which were collected during May around Florida, may indicate that the species actually is small, but it may also be that it is a short lived form which has reached that size at that particular time of the year. The colonies

show eight distinct narrow furrows, which can be traced down to the base, alternating with broad flat ridges. The entire colony is covered by a thin horny membrane. The inner tube has as usual eight strong horny ribs.

The colony is bright red, due to the color of the spicules, but the color is often more or less concealed by growth of sponges, bryozoans, etc.

The spicules are short, irregular bodies with warted surfaces and with numerous, irregularly clustered spines, often arising from short protuberances. These deposits form a kind of meshwork but they never seem to be firmly united. Between them are narrower rods with a few, simple, conical spines. No deposits of any kind have been found in the tentacles.

The largest, thick deposits are about 0.25 mm. in length; the rods may be as long as 0.20 mm.

Type: — M.C.Z. cat. no. 4529.

Type locality: — Off Conch reef, Florida, in 39–40 fms.; off Florida, no definite locality, in 50 fms., and off Caryport's Reef, in 52 fms. (Pourtalès Gulf Stream Explor.); and also from "Blake" Sta. 12, in 36 fms. (24° 34′ N, 83° 16′ W)

Specimens examined: — Those listed above: M.C.Z. cat. nos. 4528–4536.

Remarks: — A very characteristic species which at present cannot be confused with any other form known from the West Indies.

3. Telesto flavula spec. nov.

Plate 1, fig. 4; Plate 2, figs. 13–16

About ten partly broken specimens of the species are in the M.C.Z., all from the same locality.

The stolon is creeping and carries as many as seven upright axial zooids, slightly clavate. The largest stem, which is torn from its base, is 4.5 cm. high and has twelve lateral zooids, alternate or opposite, and almost in one plane. They decrease in size from 8 mm. in the lowest to 2 mm. in the uppermost. The zooids show eight distinct longitudinal furrows separated by eight flat bands, which can be traced to the basal part of the colony. The colony is completely covered by a thin, horny membrane. A cross section of the hollow "stem" shows the typical longitudinal horny bands. The color is pale yellow.

The colorless spicules never seem to fuse to any great extent. They are chiefly thick clumsy rods or spindles with warted surfaces and numerous clusters of branched spines. Beside these there are simpler, less spinous deposits of

various shape: spindles, four-armed crosses, etc. The tentacles contain a few simple rods with occasional conical warts.

The largest spicules may be as long as 0.30 mm., the rods in the tentacles 0.16 mm.

Type: — M.C.Z. cat. no. 4541.

Type locality: — Off Tortugas, in 54 fms. (Pourtalès Gulf Stream Explor.).

Distribution: — Off Tortugas, off Sombrero Isl.

Specimens examined: — Ten from the type locality, and two fragmentary specimens from Sombrero Island, no depth stated; also, two jars without any locality, M.C.Z. cat. nos. 4538–4541.

Remarks: — This species is easily distinguished on account of the feather-like arrangement of its lateral zooids in one plane, and its characteristic warty, colorless spicules. It seems to be closely related to *T. sanguinea*, and may later be placed in a new genus together with that species.

4. Telesto fructiculosa Dana

Plate 2, figs. 20–22

Telesto fructiculosa Dana, 1846, p. 632. — Laackmann, 1908, p. 74, pl. 8, fig. 32, text fig. B, (complete description and list of references).

The largest specimen described by Verrill (1866, p. 5) was 10 cm. high. The present collection contains a number of stems, about 7 cm. high, broken off from the common creeping stolon. The colony resembles a branch of spruce — that is, numerous short lateral zooids, about 1 cm. long, occur at close intervals along the sides of the axial zooid. A few zooids carry secondary zooids, but only rarely do they grow out into long branches with numerous secondary zooids as on the main stem. The colony is covered by a thin layer of horny substance. Indistinct narrow longitudinal furrows, separated by broad ribs, are present; they are more distinct on the tips of the branches. All the branches are covered by sponges and bryozoans, so that only the tips of the zooids are free. The color is bright orange yellow, due to the yellow spicules.

The spicules are short, irregular rods with clusters of spines and warts; some are spindle-like, others broad and elliptical. They vary from 0.1–0.18 mm. in length.

Type: — Most likely not preserved.

Type locality: — Off South Carolina in shallow water (Dana).

Distribution: — Off South Carolina and from several localities off Florida.

Specimens examined: — About ten branches or stems, apparently from one colony, collected off Cape Fear River, in 9 fms. (Pourtalès, Gulf Stream Exploration). M.C.Z. cat. nos. 4081–4082.

5. Telesto riisei (Duchassaing & Michelotti)

Plate 2, figs. 17–19

Clavularia riisei Duchassaing & Michelotti, 1860, p. 35.

Telesto riisei, Laackmann, 1908, p. 78, pl. 3, fig. 4, pl. 7, figs. 28–29, text fig. C. (complete list of references).

The colonies are about 20 cm. high, with creeping stolons. The "stem" of the axial zooid is about 2 mm. wide near the base and about 1 mm. near the tip. The stem is almost smooth in its lower part; in its upper part it shows eight longitudinal ridges alternating with low furrows which are equally wide. This feature becomes especially distinct in the stem of the lateral zooids. In some cases the zooids arise in pairs, sometimes in spirals with about four zooids in each turn. Near the base they stand 5 mm. apart; in the upper part there may be as much as 10 mm. between those in the same row. Some of the zooids in the upper part grow out into lateral branches which carry tertiary zooids. Most of the secondary and tertiary zooids are about 5 mm. long, obliquely placed and strongly ribbed. The tentacles are soft and in most cases completely retracted.

The zooids have eight distinct inner longitudinal ribs of horny substance. The entire surface of the colony is also covered by a thin membrane of horny substance which is specially well developed on the lower half of the zooids.

The spicules are chiefly slender rods with widely separated, conical spines. Except for a distance of few mm. behind the tentacles, most of these spicules are interlocked and fused into a network which cannot be separated by ordinary chemical agencies. Immediately behind the tentacles the spicules are free, and it is here possible to distinguish between the shorter, thicker, more spinous kind, which is located in the ribs and may be partly interlaced, and the more slender, almost thornless type which form oblique rows inside the furrows. The tentacles contain minute, almost smooth, slender rods.

The shorter, strongly spinous rods measure about 0.25 mm. in length; the longer, more slender rods about 0.45 mm.

Type: — Museum in Turin.

Type locality: — Off St. Thomas.

Distribution: — Virgin Islands; Porto Rico; Florida; St. Lucia.

Depth: — Most colonies appear to come from few fathoms depth; the material from St. Lucia is stated to come from 278 fms.

Specimens examined: — A few colonies from Key West Harbor, Florida. M.C.Z. cat. no. 4431; a colony from off St. Lucia, M.C.Z. cat. no. 4537; a jar with no locality, cat. no. 4155.

Remarks: — The description above is based upon the material from off St. Lucia which seems to agree in all essentials with Laackmann's description. I am unable to find any distinguishing characters between the material from shallow water and that from deeper water, except that the latter seems to have a greater number of simple slender rods in the upper part of the zooids.

6. Telesto rupicola (F. Müller)

Carijoa rupicola F. Müller, 1867, p. 33, pl. 9, figs. 56–57.
Telesto rupicola, Laackmann, 1908, p. 81, pl. 2, figs. 1–2; pl. 3, fig. 3 (complete list of references).
? T. africana Verrill, 1870, p. 372, text fig. 1.

This species differs from *T. riisei* (Duch. & Mich.) in being distinctly more robust (3–5 mm. near base; only 1.5–2.0 mm. in *T. riisei*), in having longer spines on the short spindles and a greater total length of the smooth long rods, and in having no fusion of the spicules except in the old part of the colony. The short bodies average 0.15–0.25 mm. in length; the long rods as much as 0.72 mm.

Type: — Probably in some European museum.

Type locality: — Off Rio de Janeiro; no depth given.

Distribution: — Known with certainty from several localities off the coast of Brazil and, according to Laackmann, known also from Kingston, Jamaica. Collected in shallow water and to depths of 10–20 fms. If identical with Verrill's *T. africana* from Sherbro Island, West Africa,[1] then known also in the eastern part of the Atlantic, and quite possibly occurring in the Indo-Pacific (New Britain, Hickson & Hiles, 1900, p. 496; and Zanzibar, Thomson & Henderson, 1906, p. 334). We have thus possibly, another instance of a hardy species being able to round the Cape of Good Hope and extending to Brazil and the West Indies, similar to Thiel's findings in the case of some of the stony corals (1928, p. 344).

[1] From Verrill's description: — "Two to four inches tall, irregularly placed zooids 0.10–0.25 inch apart, diameter 0.6–0.8 inch; zooid tubes 0.05 inch wide. Color whitish. Slender, sparingly branched spicules closely interlaced, 0.25–0.366 mm. in length. Resembles *T. fructiculosa* and is also infested with a parasitic sponge."

Specimens examined: — Two jars, one collected off Rio de Janeiro ("Hassler" Expedition, cat. no. 4157), and one without locality, but apparently from Brazil, collected either by the "Hassler" or by the Thayer Expedition, (cat. no. 4158).

Remarks: — The specimens agree with Laackmann's description, to which nothing of importance can be added.

Order III. Alcyonacea Hickson 1930

Plate 1, fig. 2; Plate 3, figs. 1–25; Plate 4, figs. 1–25

Diagnosis: — Alcyonarians with or without dimorphism, with the body-cavity of the primary individuals reaching from the surface to the base and the body-cavities of the secondary individuals elongated. Spicules as spinous rods or as crosses or stars, derived from capstans.

Remarks: — According to Hickson (1930, p. 242) this order contains five families. Two of these are well represented in the West Indian waters as well as in other parts of the Atlantic Ocean, while a third is represented by one species in the Mediterranean Sea and in deep water off the Azores,[1] and may therefore possibly be expected to occur in the western part of the Atlantic. The two other families (Siphonogorgiidae and Xeniidae) seem chiefly to be shallow water forms characteristic of the Indo-Pacific and they are not included in the key.[2]

Key to the families occurring in the Atlantic Ocean

1. Polyps able to withdraw in a cluster into the stem ..... 3. *Fascicullariidae.*
1. Polyps unable to withdraw in a cluster into the stem ..... 2.
2. Polyps uniformly distributed; dimorphism sometimes present. Colonies simple, lump-formed, fingerlike, or mushroom-shaped with a barren stem ..... 1. *Alcyoniidae.*
2. Zooids single or in bundles; colonies branching, tree-like ..... 2. *Nephthyidae.*

Family 1. ALCYONIIDAE

Diagnosis: — More or less fleshy Alcyonarians with a large amount of coenenchyma. The colonies are located or divided in a barren stem and a disk-

[1] The peculiar *Schizophytum echinatum* Studer (1901, p. 19, pl. 3, figs. 2–7), from off the Azores, 130–318 m. and referred to the now obsolete family Organiidae, probably does not belong in this order. The type was 2.5 cm. high and the spicules resemble those of a Gorgonian.

[2] A single representative of the Xeniidae viz., *Ceratocaulon wandeli* Jungersen, has been reported from the Arctic Sea only, at 538 meters, and it seems unlikely that it will be found in the Atlantic Ocean. (See Jungersen, 1892, 1916, and Hickson, 1931).

shaped part which carries the zooids, but are never tree-like. Dimorphism often developed. Spicules spinous rods or spindles, sometimes crosses.

Remarks: — The limits for the family have been discussed most recently by Hickson, 1930, p. 241. His viewpoint does not coincide in all details with those of Kükenthal and Molander. Nine genera are accepted and three of these are known from the Atlantic Ocean.

Key to the West Atlantic genera

1. Colonies irregularly shaped without distinct stem ..... 1. *Alcyonium* Linnaeus.
1. Colonies with regularly shaped disk or head and with sterile stem ..... 2.
2. Mushroom-shaped, fleshy forms with large autozooids and small siphonozooids ..... 2. *Anthomastus* Verrill.
2. Head-shaped cluster of zooids and barren stem. No dimorphism ..... 3. *Nidalia* Gray.

List of species of Alcyoniidae known from the western part of the Atlantic Ocean

Alcyonium digitatum Linnaeus
A. rubistella spec. nov.
Anthomastus grandiflorus Verrill
A. agassizii Verrill
Nidalia occidentalis Gray
N. rigida Verrill

From the northeastern and eastern part are known

Alcyonium bocagei Saville Kent
A. clavatum Studer
A. digitatum Linnaeus
A. palmatum (Pallas)
A. palmatum (Pallas) var. *acaule* Marion
Anthomastus grandiflorus Verrill
A. purpureus (Dan. & Kor.)

Genus 1. Alcyonium Linnaeus 1758

Diagnosis: — From Molander, 1915, p. 33: — Colonies membranous, or of clumsy lobular shape and without dimorphism. All zooids with generative tissue. Spicules as spindles, rods, rollers with girdles, and crosses; in the bark of the colony the rollers with girdles, and crosses are more or less numerous; all spicules strongly thorned and not lamellated.

Type species: — *A. digitatum* Linnaeus.

Key to the species of Alcyonium known from the western part of the Atlantic Ocean

1. Soft tissue; spicules as capstans and K-shaped deposits; few rods in collaret and operculum. 1. *A. digitatum* Linnaeus.

1. Hard, firm tissue; spicules as warted rods or spindles, a few capstans; numerous spicules in collaret and operculum ..... 2. *A. rubistella* spec. nov.

1. Alcyonium digitatum Linnæus

Alcyonium digitatum, Jungersen, 1916, p. 5 (complete list of references for the European specimens).— Thomson, 1927, p. 11.

(?) *A. digitatum*, Verrill, 1879d, p. 199.

A. siderium Verrill, 1922, p. 20, text fig. 3.

The smallest specimen examined is less than 1 cm. in height and the largest about 4 cm. high and 2 cm. wide. The colonies form either finger-like lobes less than 1 cm. in diameter, or flattened broad erect plates. The present specimens are all smaller and more elaborate than those from European waters which have been available.

The zooids are about 3 mm. in height and are evenly crowded all over the surface. When contracted they are visible as transparent eight-rayed stars on the opaque surface, or they form low protuberances.

The color is in all cases whitish or yellowish; the spicules are colorless.

The spicules in the coenenchyma consist of numerous capstans, sometimes in pairs; a few large X- or K-formed deposits may also be present. The transparent zooids contain an indistinct collaret with 2-3 rows of curved rods and an operculum with 6–9 double rows of converging flattened rods, with scattered spines, and often slightly bent. The maximum length of the capstans is about 0.1 mm.; the X-shaped deposits are about 0.2 mm. from tip to tip, and the rods in the zooids are 0.2–0.3 mm. in length.

Type: — Probably lost; the type of *A. siderium* is in U.S.N.M. cat. no. 30145.

Type locality: — Coast of Scandinavia; *A. siderium* came from off Cape Cod in 80 fms.

Distribution: — In American waters known off New England and Nova Scotia at depths of 8–80 fms.; in European waters off the coasts of Norway, Denmark, and Sweden, around the British Isles, and as far south as the Bay of Biscay; also off the Azores; apparently absent in the waters around Greenland; normally in water above zero in temperature, from depths of few fathoms to

about 75 fms.; greatest depth recorded, off Ireland in 115 fms., and in Bay of Biscay at 383 fms. (Jungersen, 1916, p. 7.)

Specimens examined: — Twenty-five specimens from nine localities off the coast of New England at depths varying from 8–80 fms.

Remarks: — The material has been compared with sixteen colonies from England and Helgoland. All the American colonies are smaller and most of them are more divided into lobes than the large, clumsy European forms. The spicules are much alike; but the large X- or K-shaped deposits are more rare in the American forms. In 1922 Verrill proposed that the American form, which he knew from 2 specimens, be regarded as a separate species, *A. siderium*. He does not, however, state the differences between this form and *A. digitatum*. It seems to me that they are insignificant, and that possibly a larger series would reveal the fact that there are actually no differences. The total absence of *A. digitatum* in the waters around Greenland is very remarkable, especially since all the four species of *Eunephthya* occur in that region as well as in European and American waters. Jungersen (1916) is inclined to think that the record of *A. digitatum* collected off Cape Cod was a wrong determination, as Verrill had made no reference to it since 1879. All the specimens which I have examined were labeled *A. carneum* Ag. (a synonym of *Eunephthya rubiformis*), some with the addition — "near to *A. digitatum*." The two species bear some resemblance to each other, both having the same transparent zooids with few spicules, but *A. digitatum* is covered by zooids to the base, whereas *rubiformis* has stem and branches free from zooids. Although the spicules are of similar shape and arrangement they are different (see pl. 4, figs. 20–25).

2. Alcyonium rubistella spec. nov.

Plate 1, fig. 2; Plate 3, figs. 1–7

The collection contains 4 small colonies. The largest is 2 cm. high and forms an erect rigid lobe with the zooids arranged lengthwise at various heights. The base is membranous and there are only a few zooids in the lower part of the stem. The upper part of each zooid is free and forms a shorter or longer tube with eight longitudinal furrows. The anthocodia contains numerous spicules and is completely retracted. The texture of the colony is firm, due to the large amount of calcareous matter it contains.

The colonies vary in color from pure white to white with red verrucae. The majority of the spicules are white; some are pink.

The spicules consist of pointed rods with bundles of spines arranged in an irregular fashion. Some of the rods have simple belt-like thickenings; there are also a few double heads. A collaret is present and contains several rows of curved spindles with simple spines. The tentacles have a large number of similar rods arranged in chevrons, a few of which are extremely thick and clumsy; in addition the tentacles contain smaller, more delicate spinous rods. The larger rods average 0.30–0.40 mm. in length; the double heads about 0.12 mm. In the collaret and tentacles the length of the rods may increase to 0.5 mm.

Type: — M.C.Z. cat. no. 4084.

Type locality: — Off Barbados in 123 fms. ("Blake" Sta. 297).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4085	290	73	Off Barbados	1
4083	292	56	" "	1
4086	293	81	" "	1
4084	297	123	" "	1

Remarks: — The present species closely resembles *Belonella variabilis* Studer (1901) in size, outer form, and color. The size of the spicules is somewhat greater than that indicated by Studer. His figures do not appear to be particularly accurate and conclusions cannot safely be based upon them. Molander (1915), who has examined Studer's specimen, unites *B. variabilis* with *Alcyonium compressum* Studer under *A. glomeratum* Hassall. Kükenthal (1907, p. 385), and Thomson (1927, p. 13, pl. 4, fig. 9), place it under *Gersemia*. Hickson (1895, p. 354) describes *A. glomeratum* as differing from *A. digitatum* in having more pointed, deeply divided lobes and reddish spicules, which are clubshaped, but no capstans (dumbbell-shaped spicules). His figures seem to indicate that the true *A. glomeratum* is entirely different from the present species. It may possibly be identical with Studer's *A. clavatum* (see p. 51).

Note: — It is impossible at present to say how many other species of Alcyonium there are in the Atlantic Ocean, but it seems probable that the following species are recognizable.

Alcyonium glomeratum (Hassall)

Alcyonidium rubrum Hassall, 1841, p. 285. (Nec *A. rubrum* O. F. Müller, 1776).
Alcyonidium glomeratum Hassall, 1843, p. 112.
Alcyonium glomeratum Hickson, 1895, p. 354. — Molander 1915, p. 34.
Alcyonium compressum Studer, 1901, p. 22, pl. 3, fig. 1.
Belonella variabilis Studer, 1901, p. 25, pl. 2, figs. 5, 9, pl. 10, 4–6 figs.
Not *Gersemia variabilis* Thomson, 1927, p. 13, pl. 4, fig. 9.

Remarks: — Hickson characterizes *A. glomeratum* as having more slender lobes than *A. digitatum*, and a rigid coenenchyma with reddish spicules, exclusively in the shape of clubs. It is stated to be a common species in the British seas and has also been taken in the Gulf of Gascogne.

Molander, 1919, has examined Studer's type of *variabilis* and considers it identical with *A. compressum* and *glomeratum*. Thomson's figures of *G. variabilis* are not convincing; they represent a very young colony, collected off the Azores and may probably be another species. He does not mention Molander's attempt to unite *A. variabilis* with *glomeratum*.

Alcyonium palmatum (Pallas)

Alcyonium palmatum Pallas, 1766, p. 349. — Thomson, 1927, p. 10.

A soft, deeply cleft form with slender arms or lobes, common in the Mediterranean, also collected off the Azores; ranges from 69 to 141 m.

Alcyonium palmatum Pallas var. acaule Marion

Alcyonium acaule Marion (according to v. Koch, 1891, p. 666, text fig. 17).
Alcyonium palmatum var. *acaule*, Thomson, 1927, p. 10, pl. 2, fig. 16.

Remarks: — The variety is known from the Mediterranean Sea and the Azores. According to Thomson it ranges from 48 to 1473 m. Possibly two different species.

Alcyonium bocagei (Saville Kent)

Cereopsis bocagei Saville Kent, 1870, p. 398, pl. 21, figs. 5–13.
? Gersemia bocagei, Thomson, 1927, p. 14.

Remarks: — Possibly identical with *A. glomeratum*. It was taken off Portugal in 15 fms. later reported from off the Azores in 845 m. Very likely Thomson's specimen belongs to another species.

Alcyonium clavatum Studer

Alcyonium clavatum Studer, 1901, p. 23, pl. 2, figs. 1–4.

Remarks: — It is described as a small reddish form with a tall collaret and numerous convergent rows of spicules in the operculum. It was collected from off the Azores in 318 m.

Genus 2. Anthomastus Verrill 1878

Diagnosis: — Mushroom-shaped alcyonarians with a sterile stem and few, large autozooids and numerous siphonozooids arranged on the disk. Spicules as spindles or rods, clubs and shorter dumb-bells or crosses.

Type species: — *Anthomastus grandiflorus* Verrill.

Distribution: — Indo-Pacific and Atlantic; deep sea.

Remarks: — Kükenthal, 1910, compiled short descriptions of the various species known; he recognized 10. One or two others have been described since.

From the western part of the Atlantic are known, the type species and *A. agassizii* Verrill. In the eastern part the type species occurs widespread, and another form, *A. purpurea* (Koren & Danielssen), which is closely related to *A. agassizii* but apparently never forms so large colonies.

Jungersen, 1927, maintains that there is only one species which varies according to the kind of bottom upon which it grows. But the differences between these "forms" seems so profound that they cannot be ascribed to differences in the bottom, and *A. purpureus* and *agassizii* are therefore here kept separate from *A. grandiflorus.*

Key to the species of Anthomastus known from the Atlantic Ocean

1. Stem with conical base with large winglike lobes; texture of stem sharply set off from the disk; siphonozooids prominent; autozooids marginal in position. Spicules as double crosses and mostly smooth rods ..... 1. *A. grandiflorus* Verrill.
1. Stem with broad cylindrical base, rarely with lobes; texture of stem not sharply set off from the disk; siphonozooids not prominent; autozooids scattered over the whole disk. Spicules as double crosses and spinous or winged rods ..... 2.
2. Disk large, several cm. in diameter, with numerous autozooids ..2. *A. agassizii* Verrill.
2. Disk small, few cm. in diameter, with few autozooids. *A. purpureus* (Koren & Danielssen).

1. Anthomastus grandiflorus Verrill

Plate **1**, figs. 8–9; Plate **3**, figs. 8–13

A. grandiflorus Verrill, 1922, p. 40, pl. 14, figs. 5–7; pl. 17, figs. 1–1d (complete list of references).— Jungersen, 1927, pp. 1–14, pl. 1 (*partim*?).

A. agaricus Studer, 1901, p. 27, pl. 1, figs. 6–9 (*partim*?).

This common form is represented by twelve specimens all of which have a lobed basal disk. The largest specimen is 2.5 cm. high. The stalk varies in length from quite low to long and narrow, regardless of the diameter of the disk.

In the present material the highest number of zooids is seven. The disk is covered by siphonozooids which in all cases form a rough granulated surface, due to their large size. Usually the disk is distinctly set off from the stalk by a sudden thickening of its tissue. In some of the smaller specimens the state of contraction is such that there is no line of demarcation between the barren stalk and the disk with its granulated surface.

In all cases the color is bright red or purplish, slightly varying in intensity in the different colonies.

The spicules show a certain amount of variation. In the stalk they are mostly slender rods with winged spines, sometimes almost smooth, but some of the younger colonies have thick blunt rods and innumerable double Maltese crosses in various stages of development. The tall autozooids are filled with slender rods, which are smooth in most cases. The tentacles contain shorter rods, often with brush-like divided ends. All the spicules are pale red.

The rods in the stalk may be as long as 0.40 mm.; the double Maltese crosses are between 0.07–0.13 mm. in length; the rods in the autozooids are usually 0.35 mm. long, and the rods in the tentacles about 0.20 mm. long.

Type: — U.S.N.M.

Type locality: — Off Newfoundland.

Distribution: — Common off Newfoundland, Georges Bank, Martha's Vineyard, etc., in 150–300 fms.; off the North Carolina coast in 603 fms.; off St. Vincent in 572 fms., and off Grenada in 576 fms. Also common in the eastern part of the Atlantic Ocean.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4008	227	572	Off St. Vincent	1 young
4089	309	304	" New Jersey	3 small
4090	329	603	" Carolina	12 of varying size
4088	265	576	" Grenada	1 medium size

Also, a number of specimens loaned from U.S.N.M.

Remarks: — Verrill, 1922, p. 41, suggests that Studer's *A. agaricus*, collected off Newfoundland, is a synonym of *grandiflorus* and he is undoubtedly right. He also thinks (1885) that *A. purpureus* (Dan. & Kor.) from the coast of Norway is identical with *A. grandiflorus*. Jungersen, 1927, is of the same opinion, but it seems to me that Broch's (1911, p. 31) excellent description of *A. purpureus* clearly shows that it is a separate species. Jungersen unfortunately gives no

figures illustrating the spicules. Most of his material seems to be *A. grandiflorus*. His fig. 8 may eventually prove to represent a colony of *purpureus*.

2. Anthomastus agassizii Verrill

Plate 3, figs. 14–25

Anthomastus agassizii Verrill, 1922, p. 41, pl. 17, figs. 2–2a.
A. grandiflorus Verrill (*partim*), 1922, p. 40.
A. agaricus Studer, 1901, p. 27, pl. 1, figs. 6–9, (*partim?*).

The smallest specimen is about 1 cm. high; the largest, about 8 cm. across the disk. The base is always simple and disk-shaped as in an actinian; the stem is usually short and about as thick as the disk from which it is not separated by any sharp line except when strongly contracted. The siphonozooids are not prominent and the surface of the disk is smooth and even. The autozooids are large and, except in the smallest specimen, they are always scattered all over the surface. In one of the specimens which was examined, measuring 3 cm. across the disk, there were 11 autozooids, and in the largest specimen, about 27. When the autozooids are completely retracted, an eight-rayed star indicates the place of each autozooid.

The color is bright red, the stem sometimes paler. The pinnae of the tentacles are pale, almost white. The color of the spicules is pale pink.

As in *A. grandiflorus*, the deposits consist of rods and double crosses, and they vary somewhat according to the age of the colony. In the young colony the rods have few but strong, conical spines; among the double crosses there are many which are more elongate, rod-like, or, when unequally developed, club-like. In the older colonies most of the rods are fluted, the spines are thin and wing-like, and the short double crosses predominate.

The rods are about 0.35 mm. in length; the double crosses about 0.7–10 mm., sometimes 0.15 mm. The rods in the tentacles are about 0.17 mm. in length.

Type: — M.C.Z. cat. no. 4087.

Type locality: — Off Dominica Isl. in 542 fms. ("Blake" Sta. 190).

Specimens examined: — The type (large), and a small specimen collected off Martinique in 1030 fms. ("Blake" Sta. 196); M.C.Z. cat. no. 4091; also, numerous large colonies taken off Gloucester, and from Georges Bank, previously labeled *A. grandiflorus* (loaned from U.S.N.M.)

Remarks: — This species seems distinctly different from *A. grandiflorus*. If it proves to be identical with *A. purpureus*, the latter name must be adopted.

Anthomastus purpureus (Koren & Danielssen)

Sarcophytum purpureum Koren & Danielssen, 1883.
Anthomastus purpureus Broch, 1911, p. 31, text figs. 24–27. — Molander, 1915, p. 43.
Anthomastus grandiflorus (partim), Jungersen, 1927, p. 1, pl. 1, fig. 8.
Anthomastus canariensis Wright & Studer, 1889, p. 242, pl. 37, fig. 4; pl. 41, fig. 7. — Kükenthal, 1910, p. 5.

A small form with broad base, attached to rocks, rarely with marginal lobes; stem indistinctly set off from the disk; siphonozooids small, giving a smooth surface to the disk; autozooids large, scattered over the entire disk. Spicules in the inner part of the stem as rods with few warts; in the outer layer shorter rods or crosses with foliate spines; in the tentacles the spicules are spinous to flat rods, often with brush-like ends. Color of colony bright red.

Type: — Most likely lost. Type of *A. canariensis* in Br. M.

Type locality: — Trondhjem Fjord, Norway; *A. canariensis* came from off the Canaries.

Distribution: — Off the coast of Norway, off the Canaries.

Depth: — *A. purpureus* seems to frequent 200 fms depth; the unique specimen of *A. canariensis* came from 1525 fms.

Specimens examined: — The type of *canariensis*, and three specimens from Trodhjem Fjord, and off the coast of Norway, all in Br. M.

Remarks: — Broch, 1911 has given a very careful description of the typical form from Tronhjem Fjord, and it seems to be absolutely identical with *A. canariensis*. Whether it is identical with *A. agassizii* needs to be proved. It seems to be a much smaller species than the latter and studies of the spicules may show constant differences.

Genus 3. Nidalia Gray 1835

Diagnosis: — Alcyonarians with long, slender, barren stalk and one (rarely two) large terminal head made up of the zooids, the youngest in the margin. No dimorphism. Spicules as warted, pointed rods and present in large quantities. Continental forms, occurring in the Pacific and Atlantic oceans.

Type species: — *Nidalia occidentalis* Gray.

Remarks: — Studer (1901, p. 25) uses the name *Belonella* instead of the older term *Nidalia* and gives a list of synonyms. He acknowledges that there is no sharp line between *Alcyonium* and *Nidalia*. (His *Belonella variabilis* is here regarded as belonging to *Alcyonium*, see p. 50). Besides the type species,

Kükenthal (1906,) describes five new species from Japan. The "Blake" collection contains a large number of the type species and also a new form.

Key to the species of Nidalia in the West Indies

1. Diameter of spicules about one sixth of the length.....1. *N. occidentalis* Gray.
1. Diameter of spicules about one fourth of the length.....2. *N. rigida* spec. nov.

1. Nidalia occidentalis Gray

Plate 1, fig. 5; Plate 4, figs. 1–3

Nidalia occidentalis Gray, 1835, p. 60.

The M.C.Z. collection contains about 10 specimens of this species, some of them taken from near Gray's type locality. They range from 1.2 to 5cm. in height, and even the smallest specimen shows the typical shape of the colony: a barren rigid stalk filled with large spindles, and a head with from 7 to 30 stiff conical or cylindrical zooids crowded together, the smallest in the margin. The tip of each zooid is blunt. The crown of tentacles is in all cases completely withdrawn deep into the zooid, and the outer orifice is closed by a number of smaller spicules which form a flat lid. The zooids are supported by long spindles similar to those in the stalk. Their ends do not project, and hence the margin of the zooids appears rounded. The crown of tentacles is placed far down in the body of the zooid, there being a soft tube of integument between the upper margin of the zooid and the tentacle crown. The soft tube of integument or "introvert" contains a number of flat oval rods. A large collaret is present and an operculum of slender rods, placed in chevrons. The tentacles are doubled up inside the operculum. The stalk of the tentacles is closely packed with numerous small oval deposits, whereas the pinnulae are almost without deposits. The central zooids are prolonged down through the stalk by means of wide tubes. The younger ones either have narrower tubes, or they may have no extension to the base of the colony. On account of the abundance of spicules, however, it was impossible to determine this clearly. In some parts of the colony the large tubes seem to be in direct communication.

The color of the colonies varies from pure white to pale orange. The mesenteries of the larger specimens contained ripe eggs.

The spicules consist of long spindles, which are visible with the naked eye and covered with minute clusters of spines. In addition there is an external layer, more or less developed, of smaller rods with simple conical spines. The spindles in the collaret and operculum are slender, curved rods with minute, simple spines.

The introvert and the tentacle stems contain numerous, flat, blunt deposits with scalloped edges and often constricted in the middle. A few, more irregular forms also occur in the tentacles.

The largest rods measure about 2.0 by 0.25 mm. The small spicules may be as large as 0.20 by 0.04. Opercular and collaret spicules average about 0.80 by 0.04. The flat rods in the introvert and in the tentacle stem are as large as 0.12 by 0.4 mm., and the irregular forms are of about the same size. There is a slight increase in the size of the spicules with advancing age. The measurements given above are from one of the largest specimens.

Type: — In Br. M.

Type locality: — Off Montserrat; depth unknown.

Distribution: — Known only from West Indian waters.

Specimens examined: — The type, Br. M., and the following specimens in the M.C.Z.

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4101	127	38	Off St. Croix	1 young
4097	155	88	" Montserrat	2, 1 young, 1 old
4106	231	95	" St. Vincent	1 large
4102	247	170	" Grenada	4 varying size
4105	262	92	" "	1 large stalk
4104	272	76	" Barbados	1 large
4093	276	94	" "	2, 1 large, 1 small
4096	Pourtalès Gulf Stream Explor., 65 fms., west of Tortugas, 1 medium size			
4099	"Hassler" Exp., 100 fms., Off Barbados, 1 young			

Remarks: — There is some variation in the number and size of zooids in the heads. Some colonies have a few tall zooids, while others have a greater number but they are lower and conical in shape. There is also some variation in the density of the spinulation of the large rods, but it is not sufficient to establish a variety.

The type specimen is much larger than any colony in the present material and has two heads, with 40 and 50 zooids respectively. None of the specimens in the present collection show any tendency to branch.

Nidalia rigida spec. nov.

Plate 4, fig. 4

The M.C.Z. collection contains a few specimens, 5–7 cm. high, of a form which is closely related to *N. occidentalis.* It resembles it in most respects, but

the zooids are lower and broader, and the spicules are much thicker and usually more blunt than in the type species. The diameter of the spicules is usually ¼ of the length, while in *N. occidentalis* the diameter is about ⅙ of the length. This difference is easily recognized without magnification.

Type: — M.C.Z. Cat. no. 4094.

Type locality: — Off Montserrat, in 120 fms. ("Blake" Sta. 157). Also, from St. Croix, in 44 fms. ("Blake" Sta. 133); M.C.Z. Cat. no. 4095.

Specimens examined: — Two, from the stations listed above.

Family 2. NEPHTHYIDAE

Diagnosis: — Branching, tree-like Alcyonarians with more or less barren stem; zooids in clusters or singly on tip of branches. No dimorphism. Spicules as spindles and capstans.

Key to the genera occurring in the Atlantic Ocean

1. Zooids in clusters or singly without projecting bundles of spindles on their outer side.... 1. *Eunephthya* Verrill.

1. Zooids singly with projecting bundles of spindles on their outer side..... 2. *Neospongodes* Kükenthal.

List of species of Nephthyidae known from the western part of the Atlantic Ocean

Eunephthya florida (Rathke)
E. fructicosa (M. Sars)
E. glomerata (Lütken Ms) Verrill
E. nigra Pourtalès
E. rubiformis (Ehrenberg)
Neospongodes agassizii Verrill
N. atlantica Kükenthal
N. bahiensis Kükenthal
N. caribaca spec. nov.
N. portoricensis (Hargitt & Rogers)

From the northeastern part of the Atlantic Ocean

Eunephthya florida (Rathke)
E. fructicosa (M. Sars)
E. glomerata (Lütken Ms.) Verrill
E. rubiformis (Ehrenberg)

In the eastern part of of the Atlantic Ocean

Sclcronephthya macrospina Thomson

Gersemia variabilis Thomson; nec Studer

Paraspongodes clavata Studer

Eunephthya florida (Rathke)

E. fructicosa (Sars)

The last list is partly compiled from Thomson's paper, 1927 and modified according to Broch, 1912. It is not possible to ascertain how many of his species are synonyms of other forms.

Genus 1. Eunephthya Verrill, 1879

Syn. *Drifa, Duva* Koren & Dan., etc. See Jungersen 1916, Broch 1928.

Diagnosis: — Tree-like Alcyonacea with zooids in clusters with retractile or non-retractile upper part; no projecting supporting spindles.

Type species: — *E. glomerata* (Lütken MS.) Verrill.

Remarks: — The genus is here taken in the sense defined by Broch, who in 1928 had occasion to study a large number of northern specimens and reached exactly the same conclusions as did Jungersen in 1916. Four species are known from northern waters and they all occur off the east coast of North America (although some of them have been wrongly determined). A fifth species from the West Indies was previously described by Pourtalès. The M.C.Z. possesses material of the West Indian form but only two of the northern species. Through the kindness of the U.S.N.M., however, it has been possible to examine all the material they had (about 700 specimens), and also the type of *E. multiflora* (*E. florida*), and the results agree closely with Jungersen's and Broch's conclusions. The synonyms have mostly been omitted, except those mentioned in Verrill's last paper of 1922.

Key to the species of Eunephthya known from the Atlantic side of North America

1. Spicules in walls of zooids club-shaped ..... 2.
1. Spicules in walls of zooids rod-shaped ..... 3.
2. Spicules, in the shape of long slender clubs, evenly distributed in eight converging rows. 1. *E. nigra* (Pourtalès) Verrill.
2. Spicules, as short, broad clubs, most numerous on outer side of zooids ..... 2. *E. glomerata* (Lütken MS.) Verrill.

3. Zooids non-retractile, and with the spicules most numerous on the outer side. Much branched forms with numerous small curved zooids.....3. *E. florida* (Rathke).
3. Zooids retractile, and with evenly distributed spicules in the walls.....4.
4. Zooids small, only few mm. in length, and retractile in the common cushion of tissue which forms the end of the branches.....4. *E. rubiformis* (Ehrenberg).
4. Zooids tall, up to 8 mm. in length, and retractile singly into the tubes which form the end of the branches.....5. *E. fructicosa* (Sars).

1. Eunephthya nigra (Pourtalès)

Plate 1, fig. 7; Plate 4, figs. 5–13; Plate 27, figs. 1–2

Nephthya nigra Pourtalès, 1868, p. 130.
Eunephthya nigra Verrill, 1883, p. 44. — Kükenthal, 1907, p. 350.

The M.C.Z. collection contains a large number of this striking species. The largest colonies are about 2 cm. high, with a broad base which clings actinian-like to bits of rocks. The broad, short stem gives off several short branches which carry a large number of zooids at their ends. When contracted the colony represents a short, partly barren stalk with clusters of closely packed zooids. The zooids are about 3 mm. long and pear-shaped,— that is, broadest near the tip, and have eight sharply defined longitudinal ridges. They are filled with innumerable rods placed in chevrons; many of the deposits are clubs with the thickest end distally placed. The eight ridges continue over the back of the tentacles. The coelom-cavities are prolonged to the base of the stem as wide tubes with narrow septa, two of which are better developed than the rest. These tubes are separated by thin membranes, and no perforations between them have been observed nor any connecting canals.

The color of the colony is sepia-brown with paler whitish bands on the zooids where the spicules form ridges.

The spicules in the coenenchyma consist of short, simple rollers which tend to become club-shaped. The zooids contain rods with simple blunt spines or warts, and clubs with foliated club-part and blunt warts scattered on the remaining part. These spicules form the armature of the dorsal side of the tentacles. The remaining part of the tentacles contains short simple plates or rods with warts more or less distinctly arranged in girdles.

The rollers in the coenenchyma are about 0.14 by 0.07 mm; the rods and clubs in the zooids may be as large as 0.35 by 0.06 mm; the rods in the tentacles average 0.14 by 0.03 mm.

Type: — M.C.Z. cat. no. 4112.

Type locality: — Off Sand Key, Florida, in 120 fms. (Pourtalès Gulfstream Explor.).

Specimens examined:

M.C.Z. Cat. No.

4112–13	Off Sand Key in 120 fms., 10 specimens.
4110	S. W. off Sand Key in 125 fms., 1 specimen
4114	Off Pacific Reef in 98 fms., 1 specimen
4111	No exact locality, off Florida, in 130 fms., 1 specimen

Remarks: — The present species is characterized by its dark color and its simple, slender spicules with few warts and slender, foliated clubs. The clubs are much more slender than those found in *E. glomerata*, and the zooids are symmetrically developed.

2. Eunephthya glomerata (Lütken MS) Verrill

Eunephthya glomerata Verrill, 1869, p. 284. — Jungersen, 1916, p. 14. — Broch, 1928, p. 10, figs. 1–2, 6.

Non *E. lütkeni* Verrill (from Delaware), 1883, p. 43 (= *E. fructicosa* [M. Sars]).

Drifa glomerata+ E. *thyrsoidea* Verrill, 1922, p. 31 and p. 29.

The largest colonies measure about 10 cm. in height, but colonies with a similar number of zooids may contract to hard lumps about 5 cm. in height. The stem is almost free from zooids and not rough to the touch except when strongly contracted. It gives off numerous branches which branch again and ultimately carry 3–10 zooids at various heights. When expanded the zooids are about 4–5 mm. in length with narrow base and club-shaped inwardly curving upper part with distinctly ribbed outer side. When contracted the zooids shrink to a length of 2–3 mm. and resemble small, hard, ribbed caraway seeds in dense clusters all over the colony, almost completely concealing the stem and branches. The colony is distinctly rough to the touch, especially when contracted. The color is greyish.

There are several capstans in the stem and branches. The zooids contain slender spinous rods and, mostly in their upper abaxial side, numerous more or less foliated clubs. The projecting leaves of the club-shaped part give the rough texture. In the tentacles there are a few smaller simple spinous rods.

The capstans measure about 0.10–0.13 mm.; the long rods and clubs, between 0.15 and 0.25 mm.; occasionally a slender rod may be found which is 0.45 mm. in length.

Type: — Probably in Museum of Copenhagen.

Type locality: — Off Greenland.

Distribution: — According to Broch, *E. glomerata* occurs around Spitsbergen and Nova Zembla, off the coast of Norway, around Iceland, around Greenland, and north of Canada; also from several localities off the fishing banks of Nova Scotia and New England. Except in the Arctic region this species occurs between 50 and 600 fms., where the water is at or below freezing point.

Specimens examined: — About 25 colonies from 16 lots (loaned by U.S.N.M.) collected off the fishing banks in 53–600 fms. (temperature not known), and one colony from the waters east of Greenland (Capt. Bartlett); also, three from Ottawa, examined by Verrill.

Remarks: — This species is easily recognized on account of its non-retractile, rough, asymmetrical zooids and its club-shaped spicules. The latter show a great variation, from slender to plump. The material is not sufficient to decide whether this variation is related to age or surroundings.

Verrill's *E. glomerata* taken off Delaware in 1186 fms. ("Blake" Sta. 339) is merely a retracted colony of *E. fructicosa* (likewise his *E. longiflora* from the same haul). The extreme southern occurrence of this northern species is thus eliminated, and also the record of an unusually great depth.

3. Eunephthya florida (Rathke)

Gorgonia florida Rathke, 1806, p. 137.
Eunephthya florida Jungersen, 1916, p. 16. — Broch, 1928, p. 12, figs. 3, 7.
Duva multiflora Verrill, 1922, p. 35.

The largest specimen (not particularly contracted) measures about 9 cm. in length and 12 cm. in width. This species is characterized by its thick stem, free from zooids, and by its numerous small club-shaped, not strongly ribbed, incurved zooids arranged in clusters at various heights on the end of the slender branchlets. The color is greyish or yellowish. Old material is apt to turn dark brown.

The spicules consist of capstans in the stem and branches, and simple straight spinous rods in double rows in the zooids, being most numerous on the abaxial side of the zooid. In the tentacles there are smaller spinous rods.

The capstans measure about 0.20 mm.; the rods in the zooids 0.35 mm. There is some variation in the density of the spines but it is not sufficient to establish any varieties.

Type: — Possibly in some European Museum.

Type locality: — Off the west coast of Norway.

Distribution: — According to Broch, somewhat more restricted than the foregoing species, and usually at a depth of 200 fms., 88 and 649 fms. being the extremes. Normally at a temperature of 1–4 degrees centigrade, occasionally at about 6 degrees below or at freezing point.

Depth: — From 88–649 fms.

Specimens examined: — The type of *multiflora* and about sixty colonies, taken off the fishing banks and off the coast of New England, at 110-300 fms.

Remarks: — It is on Jungersen's and Broch's authority that the present cauliflower-like form, described by Verrill as *D. multiflora*, is referred to Rathke's *E. florida*. Because of its asymmetrically developed non-retractile zooids, it might be confused with *E. glomerata*, but even quite young specimens are easily distinguished. A dead *Ceratoisis* stem, (U.S.N.M.), contains several colonies of both forms, but the roughness of the zooids in *E. glomerata* alone is a sufficient distinguishing character.

4. Eunephthya rubiformis (Ehrenberg)

Plate 4, figs. 21–25

Lobularia rubiformis Ehrenberg, 1834, p. 282.

Eunephthya rubiformis Broch, 1928, p. 14, figs. 4, 8 (list of references).

Gersemia rubiformis + *G. canadensis* + *G. carnea* + *G. fructicosa* + *G. clavata* Verrill, 1922, pp. 4, 20, 22, 23, 27, 48, with text figs.

The colonies range in size from 1 to 10 cm. They possess a well-developed stem, often ribbed, with a broad basis and with numerous short rounded branches carrying the zooids, placed as if stuck into a cushion. When contracted the zooids disappear completely into the cushions and the colony resembles a strongly lobate kidney; when expanded the colony resembles a cluster of composite flowers. The individual zooids are 2–3 mm. in lengths. They are clear, the only spicules present being confined to the indistinct collaret and the operculum. The lobes are often 5 mm. across, but in numerous cases the lobes become confluent and form much larger lumps. The contracted colonies are fairly rough to the touch although the spicules generally are scattered. The color varies from white to yellowish or from pink to brick-red.

The spicules in the stem and in the cushion-like branches consist of capstans of variable size. In the zooids they are more or less flattened rods, with a few

warts or blunt spines arranged in about 2 rows in the collaret and in 6–8 converging rows in the operculum. The spicules show much variation in the different colonies.

The capstans vary in size from 0.09 to 0.15 mm. The rods in the zooids measure about 0.20–0.30 mm.

Type: — Possibly in some European museum.

Type locality: — "E mari septentrionalis."

Distribution: — According to Broch, high arctic, circumpolar; not known from Iceland, the west coast of Norway, or the west coast of Greenland. Common also off the coast of New England and Canada.

Depth: — Shallow water, usually 20–50 fms., rarely more or less; usually found in water below zero in temperature.

Specimens examined: — About 400 colonies (mostly loaned from U.S.N.M., some from V.M., and the rest in the M.C.Z.) collected off the coasts of New England, eastern Canada and eastern Greenland; all from shallow water.

Remarks: — This species can hardly be mistaken for any other, although it shows great variability in color, size of the lobes, and size of the spicules. The same lot, however, will often contain all the possible variations, and it is therefore unlikely that the species can be divided into smaller units. Most of the material has been listed as *A. carneum* Ag., the red colonies as *E. rubiformis*. Both *Gersemia canadensis* and *carnea* in Verrill's last paper represent *Eunephthya rubiformis*, as well as his *G. clavata*, and *fructicosa*. All of his material has been re-examined.

5. Eunephthya fructicosa (M. Sars)

Plate 1, fig. 6; Plate 4, figs. 14–20

Alcyonium fructicosum M. Sars, 1860, p. 140.

Eunephthya fructicosa Jungersen, 1916, p. 11. — Broch, 1928, p. 16, figs. 4 (labeled *rubiformis*),[1] 9.

Gersemia fructicosa + *G. longiflora* + *G. mirabilis* + *G. studeri* Verrill, 1922, pp. 23, 26, 48.

The colonies reach a height of about 10 cm. They have a well developed stem, which is in general strongly ribbed and rough to the touch. The basal portion in the young specimens is attached to small objects, such as the slender branches of a dead *Ceratoisis*. In the larger specimens it forms a bag-like mud-

[1] Broch's figure 5, "*E. fructicosa*", is without doubt wrongly labelled. Both the shape of the spicules and their variation indicate *E. rubiformis;* likewise his statement that some of them are deep red. I have never seen any reference to the occurrence of red spicules in *E. fructicosa*. The spicules in his figure 4 labeled *rubiformis*, resemble much more those of *fructicosa*.

filled tube which undoubtedly anchors the colony in the soft bottom. Numerous branches carry a number of large zooids, about 8 mm. in length when in an expanded condition. The zooids are regularly developed and cylindrical in shape, with eight converging rows of slender spicules. They are able to contract. When half contracted they resemble acorns, the lower, less spiculose part expanding cuplike around the upper part of the zooid; when completely retracted, the lower part encloses the upper portion completely, causing the individual zooid to appear somewhat larger and more shapeless than when it is expanded.

The stem contains numerous short rods derived from capstans. The base of the zooids (or terminal parts of the branches) contains similar short blunt rods, thicker or thinner, with scattered blunt warts. The zooids contain innumerable long slender rods with a few scattered spines; in the tentacles are a few short rods.

The rods measure about 0.15–0.20 mm.; the long rods in the zooids about 0.25–0.35 mm.

Type: — Probably in Norway.

Type locality: — Off coast of Norway.

Distribution: — According to Broch almost circumpolar, although not known from the waters north of Alaska. Normally found in waters below 5° C. in temperature. In the arctic region this species occurs in less than 50 fms., but in the "cold area" off the coast of Greenland it is found exclusively at a depth of about 1500 fms., sometimes 2000 fms. All the specimens from the Atlantic coast of North America were collected from a depth of about 1500 fms.

Specimens examined: — About 150 specimens collected off Delaware and off the coast of New England, mostly loaned from U.S.N.M., except the two specimens from Blake Sta. 339, off Delaware, in 1186 fms. (the type of *E. longiflora* and a colony wrongly called *E. glomerata* by Verrill. (M.C.Z. cat. no. 4526, 4168.)

Remarks: — Jungersen's excellent paper of 1887, p. 375, unfortunately published in the Danish language, has been used as the basis for the determination of the present material. He emphasizes the "sleeve-like" elongations of the basal portion, filled with mud, that anchor the larger specimens in the soft sea bottom, a typical character of all the larger specimens and not found in any of the other species. He also emphasizes the tree-like branching structure with only scattered zooids on the stem; the rough and furrowed surface of the latter, and the large size of the zooids, much larger than in any of the other species. The size of the spicules (0.09–0.13 mm., and 0.19–0.32 mm. for the rods in the branches and in the zooids respectively) is in agreement with the measurements

made of the present material. His figures illustrating his material apply equally well to the American specimens. His statement that the zooids are completely retractile as in *Alcyonium digitatum* may perhaps be interpreted as signifying the way in which the upper part of the zooids is completely withdrawn and covered by the lower part; Thomson's expression (1927, p. 15) — "complètement rétractile et se tenant isolés"— seems to me more correct since there is no common mass of coenenchyma into which the zooids may retract, as in *A. digitatum* and *E. rubiformis*.

Verrill's *E. longiflora* and *E. lütkeni* (*glomerata*), taken off Delaware, are both specimens of *E. fructicosa*, a bloated and a contracted specimen respectively. Jungersen was therefore correct when he guessed (1887) that *E. longiflora* was a synonym of *E. fructicosa*.

Verrill's *E. fructicosa* (1922, p. 23) from Richmond Gulf, east of Hudson Bay is *E. rubiformis*. It was collected in only 15–30 fms., but in the arctic region *E. fructicosa* may possibly occur in much shallower water than off the coast of America and Greenland, where it is taken at depths averaging about 1500 fms.

Studer's *Paraspongodes clavata* from 927 m. off the Azores (1901, p. 31) is not figured, and the description is not sufficiently detailed to make it certain whether or not it is *E. fructicosa*, as Jungersen suggests (Broch, 1928, p. 19).

Gersemia mirabilis, Verrill (1922, p. 26) is undoubtedly a young *E. fructicosa*, as Verrill himself suggests (p. 27). It was a slip of memory when Verrill stated that the U.S.N.M. had several specimens of *G. mirabilis* from deep water off Newfoundland and Nova Scotia. All their material was identified by Verrill as *E. longiflora*.

Genus 2. Neospongodes Kükenthal 1903

Diagnosis, from Kükenthal, 1903a, p. 273: — Nephthyids of tree-like structure; zooids isolated or in bundles, with supporting rods; canal walls forming an irregular axis in the center of the stem and larger branches.

Type species: — *Neospongodes atlantica* Kükenthal.

Remarks: — Two species, taken off Bahia, Brazil (no depth indicated), were described, namely, *N. atlantica* and *bahiensis*, (Kükenthal 1903a, p. 274), both in collections in Hamburg. No figures illustrating the specimens were given. Kükenthal suggested that *Spongodes portoricensis* Hargitt and Rogers belongs to this genus.

The "Blake" collection contains a large number of a species which, I think, is identical with *N. portoricensis*, and two other forms, one of which may prove to be identical with one (or both) of Kükenthal's species, while the other seems to be new.

Key to the species of Neospongodes in the West Indies

1. Colonies short, with short branches or lobes crowded with zooids. Supporting rods not sharply defined and rarely projecting to any extent. Color white, semi-transparent..... 1. *N. portoricensis* (Hargitt and Rogers).

1. Colony slender, with slender stem and branches and only a few scattered zooids. Supporting rods distinct in strongly projecting bundles.....2

2. Spicules not remarkably long; branches slender; zooids non-retractile..... 2. *N. agassizii* spec. nov.

2. Spicules remarkably long, up to 1 cm.; branches thick; zooids completely retractile..... 3. *N. caribaea* spec. nov.

Remarks: — The two Brazilian species are not included in the key as the descriptions seem insufficient. On gathers from these that the two species are closely related and also show strong affinities to *N. agassizii*. Very likely *N. bahiensis* and *agassizii* will prove to be synonyms of *N. atlantica* but for the present it cannot be proved.

1. Neospongodes portoricensis (Hargitt & Rogers)

Plate 1, fig. 10; Plate 27, figs. 3–12

Spongodes portoricensis Hargitt & Rogers, 1901, p. 279, text fig. B. — Kükenthal, 1903a, p. 273; 1905, p. 718.

The collection contains a large number of an Alcyonarian which appears to be identical with the one described as *Spongodes portoricensis* by Hargitt and Rogers. The colonies may be as high as 6 cm. but they are much shrunken in alcohol. There is a thick fleshy stem, usually short, with a broad disc-shaped base and a number of short thick branches. The zooids are scattered irregularly on the stem and all over the branches without any definite arrangement. When well-expanded they represent a long cylindrical, upward curving "neck" at the end of which the cluster of tentacles is placed. They are armed, chiefly on the outer side, with two rows of converging curved spindles, which project very little. There is an indistinct collaret, and an operculum which usually does not close and which contains eight pairs of curved spindles, arranged in a triangle, and one or two smaller spindles. The spindles in a pair are often of unequal length.

The spicules on the stem and branches are slender pointed spindles with simple conical warts scattered all over the surface. The center of the stem is gelatinous, surrounded by large canals, and contains a variable number of spindles.

The average length of the spindles in the coenenchyma and on the outer side of the zooids is 1–1.25 mm.; a few longer ones may be present. The heavier bent rods in the operculum may be as long as 1.50 mm. The short thick rods in the tentacles average 0.20–0.40 mm.

Type: — Apparently lost; not in U.S.N.M.

Type locality: — Off Porto Rico, in 75 fms.

Specimens examined:

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4176	152	177	Off St. Croix	5
4186	155	88	" Montserrat	1
4161	203	96	" Martinique	4
4185	203	96	" "	1
4172	243	171	" Barbados	5
4188	249	264	" Grenada	2
4167	269	124	" St. Vincent	4
4171	269	124	" " "	2
4162	272	76	" Barbados	1
4179	272	76	" "	2
4166	272	76	" "	3
4169	272	76	" "	3
4177	276	94	" "	3
4190	276	94	" "	1
4181	290	73	" "	3
4183	290	73	" "	1
4164	292	56	" "	3
4184	292	56	" "	1
4178	293	81	" "	4
4170	294	136	" "	1
4187	296	85	" "	1
4180	297	123	" "	2
4173	298	120	" "	3
4174	No label			1
4189	" "			1
4192	" "			1

Remarks: — It is possible that in the future this species will be placed in another genus. The supporting bundles are much less pronounced than in the two other forms. It has, however, a very distinct central column which is supposed to be characteristic of the typical forms of *Neospongodes*. As there has been no material available of other genera I have retained it in *Neospongodes*. It resembles superficially *Scleronephthya macrospina* collected off the Azores in 599 m. (Thomson, 1927, p. 16, pl. 3, fig. 11.)

2. Neospongodes agassizii spec. nov.

Plate 1, figs. 11, 12

The "Blake" collection contains several specimens of this well defined species ranging from a few cm. in height to about 10 cm. (with the basal portion missing).

The colony has a strong main stem, rather firm and spiculose, and a varying number of long slender branches which are given off at wide angles and bent gently upward. Occasionally they are bifurcate. A few zooids are scattered on the stem. On the branches they are irregularly distributed, though never crowded, and resemble buds on a tree. The zooids appear to be non-retractile. They consist of a distinct bracket-like portion with two bundles of projecting spines and a bud-like portion consisting of the collaret and operculum. In all cases the tentacles are retracted.

The stem is grayish, the branches reddish-brown, and the zooids pale in color.

The spicules consist of closely packed, parallelly arranged spindles in the outer layer of the stem and branches. A few rods are present in the gelatinous central part of the stem. The zooids contain a well-developed collaret with four to six rows of slender curved warted spindles. The operculum consists of two pairs of strongly bent spindles, sometimes with a smaller pair between them. The tentacles contain a number of short blunt-ending curved warted rods and there are several minute lozenge-shaped rods in the pinnulae.

The spicules in the coenenchyma may be as long as 2 mm.; the spicules in the collaret 1 mm., and the opercular spindles are approximately the same length. The blunt rods in the tentacles may reach 0.30 mm. in length.

Type: — M.C.Z. cat. no. 4069.

Type locality: — Off Cuba, in 101 fms. ("Blake" Sta. 45).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4069	45	101	Off Cuba	10
4369	132	117	" St. Croix	2frag.
4381	155	88	" Montserrat	2
4370	157	120	" "	1
4075	158	148	" "	1
4074	203	96	" Martinique	3
4390	203	96	" "	4
4372	203	96	" "	2
4379	216	153	" St. Lucia	1
4377	231	95	" St. Vincent	2
4395	231	95	" " "	3
4373	247	170	" Grenada	1
4392	269	124	" St. Vincent	1
4072	272	76	" Barbados	1
4378	272	76	" "	4
4389	272	76	" "	1
4070	273	103	" "	3
4383	276	94	" "	5
4391	276	94	" "	1
4396	277	106	" "	1
4371	278	69	" "	3
4385	290	71	" "	fragments
4073	294	136	" "	1
4376	296	125	" "	1
4382	296	125	" "	1
4398	298	125	" "	1
4374	locality lost			1
4386	" "			1
4387	" "			1

Remarks: — *N. agassizii* seems to be closely related to the forms which Kükenthal 1903a, p. 274 describes from the waters off Bahia (in the Zoöl. Mus., Hamburg) and may prove to be identical with one or both of them. (See p. 66 above.)

3. Neospongodes caribaea spec. nov.

Plate **1**, figs. 13, 14; Plate **27**, fig. 13

The type specimen is about 12 cm. high. It is a robust form with a thick short stem, about 1.5 cm. in diameter near the base, which almost immediately

gives off a number of branches. The branches are stout and of almost equal thickness at base and top (5 mm. in diameter). A few of them give off short secondary branches. All the zooids are completely retracted into their lower part which is conical, bracket-like, and supported by a number of large projecting spindles, usually in two diverging bundles. A small round opening on the upper soft-skinned side indicates the place into which the zooid has retracted. The integument is soft and fleshy, with several large spindles which may be 6 mm. in length. The interior consists of several tubes arranged around a fleshy columella which, in spite of its softness, contains a number of large spicules.

Color in alcohol dull greenish gray.

The zooids have a well-developed collaret with about six rows of curved, finely warted spicules. The operculum contains one pair of similar, large rods, and often a pair of smaller rods. In the tentacles there are a few short curved rods and a large number of minute flat lozenge-shaped rods, constricted in the middle.

The spicules in the coenenchyma are long, tapering spindles covered with minute composite warts; there is also a number of small spindles.

The longest spicules measure 6.0 mm. in length; few of them are 1 cm. The rods in the collaret are about 1.5 mm. long, the opercular rods about 1.0 mm. The short double cones in the tentacles average 0.05 mm. in length.

Type: — M.C.Z. cat. no. 4068.

Type locality: — Off Martinique; no depth. Steamer "Enterprise," Captain Cole, coll.

Specimens examined: — The type, and a fragment without locality (cat. no. 4394). Verrill's manuscript also lists this species from 96 and 94 fms. off Barbados ("Blake" Stations 272 and 276), but these colonies appear to have been lost.

Remarks: — The large specimens of this form are very different from *N. agassizii*, but it is quite possible that some of the short contracted specimens, listed as young *N. agassizii*, actually belong to *N. caribaea*. The lozenge-shaped deposits in the tentacles of the contracted specimens, listed under *N. agassizii*, are numerous and the zooids may be withdrawn, as is typical in *N. agassizii*. However, the deposits in the coenenchyma seem to be smaller and more numerous than one would expect in a young colony of *N. agassizii*.

Note: — Other species in the Atlantic Ocean. *Scleronephthya macrospina* Thomson, 1927, p. 16, seems to belong in this genus and may possibly be *N. portoricensis*.

Family 3. FASCICULARIIDÆ

Diagnosis: — See Kükenthal, 1925, p. 713; Hickson 1930, p. 245. Indo-Pacific and Atlantic forms.

Remarks: — Three genera are recognized by both Kükenthal and Hickson. None of the genera have been reported from the West Indies.

Note: — From the eastern Atlantic are known: —

Paralcyonium elegans Milne-Edwards, from 880 m. off the Azores (Thomson, 1927, p. 12 pl. 2, figs. 8, 15.) It may therefore be expected also in the western part of the Atlantic Ocean.

Fascicularia edwardsi (Lacaze Duthier) is a Mediterranean shallow water form. Most recently discussed by Motz-Kossowska and Fages, 1907, p. 423–443.

Family 4. XENIIDAE

Diagnosis: — Small fleshy Alcyonarians with one pair of dorsal mesenteric filaments and tentacles usually with two, three or more, longitudinal rows of pinnules. Calcareous spicules when present are minute round or oval corpuscles or rarely thin rods.

Remarks: — A very careful revision has been given by Hickson, 1931. According to him only one form is known with certainty from the Atlantic Ocean, viz., *Ceratocaulon wandeli* Jungersen, briefly described in 1892 and 1916, from Davis Strait and east of Iceland, at about 300 fms. (According to Kükenthal 1906, p. 19, it is closely related to *Xenia antarctica*). From the distribution of other arctic forms it seems rather unlikely that the species would occur further south in the Atlantic. From the eastern part of the Atlantic Ocean a number of species are known which have been referred to the Xeniidae, but it is impossible to discuss their proper position in this connection.

Order IV. Gorgonacea Verrill 1865

Plates **5-15**; **28-30**

Diagnosis, from Kükenthal, 1925, p. 716: — Colony-building Octocorals which are always sessile, usually tree-like. The zooids are all of the same type, with short gastral cavity, and the individuals are mutually connected by solenia. The coenenchyma of the colony is differentiated into an outer and an inner layer. In the outer layer or cortex, the sclerites are isolated; in the inner, the sclerites are

surrounded by a horny substance, sometimes united to a solid horny axis which consists partly of sclerites cemented together by a calcareous substance; or else the axis consists solely of a horny substance, while the sclerites have disappeared. Amorphous crystalline calcium carbonate may be deposited in the horny mass. Dimorphism of the zooids has been demonstrated in two genera only.

The order contains 12 families.

Key to the families

1. The sclerites in the inner layer are either loose, or united, completely or incompletely, to an axis, either by horny mass or by calcareous substance.....Suborder *Scleraxonia* 2.
1. The axis consists of horny substance in which calcium carbonate may be deposited to varying extent and distributed in various ways.....Suborder *Holaxonia* 5.
2. The sclerites of the inner layer are surrounded by a coating of horny substance..... 1. *Briareidae.*
2. The sclerites are united by calcareous mass and form a solid axis.....3.
3. The axis is jointed, with alternating horny and calcareous joints..... 4. *Melitodidae* (Indo-Pacific).
3. The axis is not jointed.....4.
4. The sclerites of the axis are connected by their lateral projections only..2. *Subcrogorgiidae*
4. The sclerites of the axis are completely cemented together by calcareous mass..... 3. *Coralliidae* (Indo-Pacific and eastern Atlantic).
5. The axis is jointed.....12. *Isididae.*
5. The axis is not jointed.....6.
6. The central core is soft and chambered.....7.
6. The central core is calcified and solid.....10.
7. The cortex of the axis is not loculated[1].....8. *Gorgoniidae.*
7. The cortex of the axis is loculated.....8.
8. The zooids have an operculum composed of strong spindles.....7.*Muriceidae.*
8. The zooids have no operculum of strong spindles.....9.
9. The zooids are retractile into the lower stiffened part.....5. *Plexauridae.*
9. The zooids are not retractile; the walls are stiffened by long rods...6. *Acanthogorgiidae.*
10. The lamellae of the cortex of the axis are undulated; sclerites are scale-like.9. *Primnoidae.*
11. The sclerites are twin-balls or twin-spindles; occasionally clubs.....10. *Gorgonellidae.*
11. The sclerites are flattened rods and plates.....11. *Chrysogorgiidae.*

Kükenthal, 1919, pp. 740–786, gave a complete list of families, genera, and species with their distribution, depth, and reference to all the more important papers. In 1924 he published a second account covering the same group, but with short, condensed descriptions. It is quite evident, however, that large

[1] See p. 29. (Definitions.)

parts of this important paper are based upon review of old, insufficient descriptions, and not upon actual examination of material. This is particularly true of the family Muriceidae, which is so well represented in the West Indies. The following descriptions of the genera and species, occurring in that region, will therefore be found to differ in several respects from those of Kükenthal.

Suborder SCLERAXONIA

Family 1. BRIAREIDAE

Plate 5

Diagnosis, from Kükenthal, 1919, p. 736:— The colonies are either incrusting, or they rise from the substratum as branched or unbranched, open or closed tubes, or as solid projections. The calcareous deposits in the medulla are not wedged together by a calcareous substance to form a reticulum. Beneath the superficial network of solenia, which connect the gastral cavities, there are wide longitudinal tubes which sometimes are absent from the medulla. The sclerites are fundamentally in the form of belted rods and warted spindles; also as stars and crosses. In the medulla are longer, more slender spicules, often with large projections. Dimorphism reported in one genus (*Paragorgia*). Indo-Pacific and Atlantic forms; chiefly littoral.

Remarks: — Kükenthal, 1919, p. 740, gives a list of genera and species. There are known in all forty-six species and varieties, distributed among fourteen genera. Five genera are represented in the West Indian region, with five species and two varieties, and two genera are reported from the northeastern coast of the United States, each with one species. Four genera are represented in the "Blake" collections.

Briareidae from the West Indies and Brazil: —

Erythropodium caribaeorum (Duchassaing & Michelotti). Not in the "Blake" material.

E. polyanthes (Duchassaing & Michelotti).

Briareum asbestinum (Pallas), and *B. a.* var. *?*

Iciligorgia schrammi Duchassaing.

Suberia clavaria Studer.

Titanidium suberosum (Ellis & Solander).

Diodogorgia nodulifera (Hargitt & Rogers).

D. ceratosa Kükenthal.

Keroeides richardii (Lamouroux).

From northern waters: —

Paragorgia arborea (Linnaeus).

Anthothela grandiflora (M. Sars).

From the eastern Atlantic Ocean are reported: —

Erythropodium astraeoides Studer, 1901, p. 16, a doubtful form from the Bay of Biscay, in 63 fms.

Titanideum obscurum Thomson, 1927, p. 18, off the Azores in 1250 m. Doubtful.

Suberia capensis J. S. Thomson, littoral, from South Africa.

Spongioderma chuni Kükenthal, littoral, from South Africa.

S. capensis Kükenthal, littoral, from South Africa.

Corallium rubrum L., off Madeira, coast of Ireland, and from the Mediterranean, abyssal.

C. johnsoni Gray, off Madeira, abyssal.

C. maderense (J. Y. Johnson), off Madeira, continental.

C. tricolor (J. Y. Johnson), off Madeira, continental. For literature, see Kükenthal, 1924, pp. 47–52.

Key to the Briareidae

From Kükenthal, 1919, p. 29. As the Briareidae represents a rather difficult group, it has been considered the best course to repeat the whole key, especially since some of the genera which have not yet been reported from the West Indian or Brazilian waters very likely do occur there, but simply have been overlooked because they are fairly inconspicuous. An incomplete key may easily prove to be extremely misleading in this group.

1. Colonies form membraneous coverings over the substratum, but do not develop stems. (*Erythropodiinae*) *Erythropodium.*[1]
1. Colonies have vertical stems ..... 2.
2. Zooids developed on base as well as on stem (*Briareinae*) ..... 3.
2. Zooids not present on base which is reduced to a small basal disk for attachment ..... (*Paragorgiinae*) 6.
3. Stems canaliculated or tubulated ..... *Solenopodium.*
3. Stems solid ..... 4.
4. Stems with numerous anastomoses ..... 2 *Anthothela.*
4. Stems without any anastomoses ..... 5.
5. Zooids without lower rigid part, and able to retract completely into the coenenchyma. 3 *Briareum.*

[1] This genus was earlier (1906) placed among the Alcyonacea (see Molander, 1915, pp. 33 and 37). In 1916 Kükenthal treated the genus among the Briareidae from the West Indies. Possibly some of the species of *Erythropodium* belong to the Alcyonacea.

5. Zooids with lower rigid part wherein they may retract ..... *Pseudosuberia.*
6. The central core is perforated by soleniae ..... 7.
6. The central core is not perforated by soleniae ..... 10.
7. The zooids are dimorphic ..... 4. *Paragorgia.*
7. The zooids are not dimorphic ..... 8.
8. Zooids without lower rigid part ..... *Machaerigorgia.*
8. Zooids with lower rigid part wherein they may withdraw .....
9. Stem and branches cylindric ..... *Semperina.*
9. Stem and branches flattened, with secondarily formed canals or tubular structures .... *Solenoeaulon.*
10. Stem and branches flattened; zooids placed on the edges biserially ..... 5. *Iciligorgia.*
10. Stem and branches round; zooids distributed on all sides ..... 11.
11. Zooids without lower rigid part ..... 12.
11. Zooids retractile into lower rigid part ..... 13.
12. Spicules typically in the form of very small three-to-four-armed bodies, and girdled rods. 6. *Titanideum.*
12. The typical form of spicules is warted spindles ..... *Paratitanideum.*
13. Colony unbranched ..... 7. *Suberia.*
13. Colony branched ..... 14.
14. Zooids without spicules ..... *Spongioderma.*
14. Zooids closely packed with small spicules ..... 8. *Diodogorgia.*

All the genera are treated by Kükenthal, 1924, pp. 8–40.

Genus 1. Erythropodium Kölliker 1865

Diagnosis, from Kükenthal, 1919, p. 31.— The colony forms a membranaceous sheath which never rises from the substratum. The zooids are small, without any definite verrucae, and completely retractile. The gastral cavity is indirectly connected with the solenia by a network of tubes. The coenenchyma is developed as an outer and an inner layer, each layer with differently shaped and colored spicules. The typical forms of the spicules are spindles, crosses, and stars. A skeleton of horny substance is also present and forms a membrane in the basal part.

Type species: — *E. caribaeorum* (Duch. & Mich.)

Remarks: — The genus is at present known from both the West Indian region and the Pacific Ocean, exclusively as shallow water forms. Kükenthal (1919, pp. 32–37) lists two certain and two uncertain species.

From the West Indies is known *Erythropodium caribaeorum* (Duch. & Mich.) and *E. polyanthes* (Duch. & Mich.). Numerous specimens of the former have

been collected by Kükenthal and Hartmeyer from shallow water in the West Indies (no localities are given). For list of references, description, history, etc., see Kükenthal, 1916, p. 445, figs. A–E, and 1919, p. 34; also 1924, p. 10.

The type species has not been examined, but *E. polyanthes* is well represented in the M.C.Z. (Duchassaing & Michelotti's material).

Key to the West Indian Species

Coenenchyma thin (at most, 4 mm. thick); spicules short rods, crosses, or stars with numerous tufts of warts.....1. *E. caribaeorum* (Duchassaing & Michelotti).

Coenenchyma thick (at least 10 mm. thick); spicules long thick rods with numerous narrow belts of warts.....2. *E. polyanthes* (Duchassaing & Michelotti).

1. Erythropodium caribaeorum (Duchassaing & Michelotti).

Xenia caribaeorum Duchassaing & Michelotti, 1860, p. 16, pl. 1, figs. 8–11.
E. caribacorum Kükenthal, 1916, p. 445; 1919, p. 34; 1924, p. 10, fig. 8.

Apparently common in shallow water in the West Indies. No specimens have been examined.

2. Erythropodium polyanthes (Duchassaing & Michelotti)

Pl. 5, fig. 23.

Ammothea polyanthes Duchassaing & Michelotti, 1860, p. 15, pl. 1, fig. 6.
Ammothea parasitica Duchassaing & Michelotti, 1860, p. 15, pl. 1, figs. 3–5.
Erythropodium marquesarum Kükenthal, 1916, p. 173; 1919, p. 34; 1924, p. 11, text-figs. 9–10.

The M.C.Z. possesses a considerable amount of material from St. Thomas, sent by Kölliker to Verrill, but it was never incorporated in his manuscript.

The colonies form round, thick lobes about 1 cm. in thickness over dead pieces of stony coral. The surface is smooth and even in the dry material, and the zooids are well distributed except near the edges. They are not contracted but form short soft tubes which have become flattened in drying. The color of the colony is pale yellow with bluish-red zooids.

The spicules consist of a basal layer of mostly bright red, irregularly formed spindles with scattered tufts of warts. The outer layer and the zooids contain simple spindles with a large number of transverse rows of warts. The horny substance is sparingly developed.

The spicules may be as long as 0.50 mm.; Kükenthal gives 0.36 mm. as his largest measurement.

Type: — Possibly in Turin.

Paratype: — M.C.Z., cat. no. 4216.

Type locality: — Off St. Thomas, no depth given.

Distribution: — St. Thomas, Marquesas Keys, Florida.

Specimens examined: — A number of colonies from Duchassaing & Michelotti's collections.

Note: — From the eastern Atlantic Ocean Studer (1901, p. 16, pl. 1, figs. 3–5) describes *Erythropodium astraeoides*, collected in the Bay of Biscay, near Belle Ile, in 63 m. A doubtful form not mentioned by Kükenthal 1924.

Genus 2. Anthothela Verrill 1879

Diagnosis, from Kükenthal, 1919, p. 43:— Colony, with membranous, expanded base from which arise several stems with numerous anastomoses. Zooids are large, and occur on the base as well as on the stems, sometimes more numerous on one side of a stem than on the other. They are able to retract into the high verrucae. The coenenchyma contains long spinous spindles and shorter girdled rods. The medulla is not well differentiated from the cortex; it is spongeous and filled with slender spindles and rods, and is perforated by solenia. Color pale rose, or brownish.

Type species: — *A. grandiflora* (M. Sars).

Remarks:—The genus includes, according to Kükenthal, one certain and one doubtful species. The former is restricted to the North Atlantic Ocean, and is a deep littoral and continental form. See Kükenthal, 1924, p. 14.

1. Anthothela grandiflora (M. Sars)

Briareum grandiflorum M. Sars, 1856, p. 63, pl. 10, figs. 10–12.

Anthothela grandiflora Kükenthal, 1924, p. 15, text figs. 13–14 (complete list of references). —Verrill, 1922, p. 18, pl. 6, figs. 1–4, text fig. 4. — Thomson, 1927, p. 16, pl. 1, fig. 20; pl. 3, fig. 34; pl.4, figs. 6–18; pl. 5, fig. 28. — Molander, 1918, pp. 6, 14.

Rhizoxenia alba Grieg, 1887, p. 3, pl. 1, figs. 1–34.

This species which forms both incrusting membranes and erect stems, has been described in detail by Verrill, 1922, and Thomson, 1927.

Type: — Possibly in Norway.

Type locality: — West coast of Norway.

Distribution: — In the eastern part of the Atlantic Ocean it is known from the coasts of Scandinavia and as far south as the Azores. In the American waters

it is known from deep water of Newfoundland and Nova Scotia. It may possibly occur also in the West Indies.

Depth: — From 150–240 meters.

Specimens examined: — None.

Genus 3. Briareum Blainville 1830

Diagnosis, from Kükenthal, 1919, p. 45: — Thick cylindrical stems which rise vertically from a membranous base. The zooids are without any verrucae and may contract completely. The cortex has no distinct outer layer, and the medulla is not separated from the cortex. Solenia are present in the deeper layer of the cortex and in the medulla. The cortex contains long spindles and three-armed rods with high irregular spines; similar but larger deposits occur in the medulla together with a horny meshwork. Color yellowish or reddish; medulla, blue-red.

Type species: — *Briareum asbestinum* (Pallas).

Remarks: — Known only from the West Indies; shallow water, to depths of about 35 fms. One species and one variety, both in the "Blake" material.

1. Briareum asbestinum (Pallas)

Pl. 5, figs. 1–2

For complete list of references, history, description, and discussion, see Kükenthal, 1916, p. 469, pl. 23, fig. 2, text-figs. F–H; 1919, p. 47, fig. 18; 1924, p. 16, fig. 15.

The "Blake" collection contains one specimen of this relatively common form. It is about 10 cm. high and 1 cm. thick, with a base about 4.5 cm. wide. The zooids are uniformly distributed over the surface, and are completely contracted into the coenenchyma. The texture of the colony is peculiar on account of the admixture of horny substance and calcareous spicules.

Color pale yellow; in certain places reddish.

The spicules in the outer layer of the coenenchyma are in most cases colorless; a few are red. They represent tapering spindles covered with a variable number of small scalloped spines or warts; the number of these projections seem to increase with increasing size of the spindles. The character of the spicules changes gradually in the inner layer where most of the deposits are red; here there are, beside the typical spindles, branched forms, three- to four-armed, often curved, and with small lateral branches covered by branched spines or

warts. Smaller deposits may also occur. The horny substance is best developed in the inner layer, and it is rather difficult to separate the spicules of the "axis." The tentacles may or may not contain spicules; if they are present they are red and white, mixed together, and of similar shape, as in the outer layer, but smaller and often curved.

The largest spicules in the "axis" are about 1.00 by 0.18 mm.; the average is 0.40 by 0.7 mm.

Type: — Most likely lost.

Type locality: — West Indies.

Distribution: — The species seems fairly common in shallow water throughout the West Indies.

Specimens examined: — One colony taken off Carysfort reef, Florida, in 35 fms. (Pourtalès Gulf Stream Explor.) M.C.Z. cat. no. 4211. — Several colonies, all in the M.C.Z., from earlier collections.

Remarks: — The spicules of the present specimens are slightly larger than those measured by Kükenthal; the largest spicules from the "axis" reported by him measured about 0.7 mm. whereas the present specimen has spicules as long as 1 mm. I do not think that this difference is sufficient grounds for establishing a new species, neither is there anything remarkable in the depth at which the specimen from Carysfort was taken.

1a. Briareum asbestinum (Pallas) var.?

Duchassaing & Michelotti (1860, pp. 15–16, pl. 8, fig. 15, and pl. 11, fig. 7) described two forms of *Briareum* from the "Antilles" and off Guadeloupe, respectively. Kükenthal (1916, l.c.) regards the first one, *B. capitatum*, as a synonym of *asbestinum;* the other, *B. palma christi*, he lists as a doubtful species (1919, p. 741).

The collection in the M.C.Z. contains four specimens, all from the same locality (off the Florida reefs), which show that these two forms can hardly be kept separate, but it is a question whether they represent distinct varieties or merely growth stages of the typical form, the development of which, as far as I know, has never been followed through its successive stages.

One specimen is flat, with the zooids on the upper side only; another specimen is ear-shaped, with the zooids arranged along the thickened edge. A third represents a short thick wall with zooids chiefly on one side, and the fourth is rod-shaped, with a thickened terminal part.

The colonies are all much smaller than the full-grown colonies of *B. asbestinum* as usually described. The flat, leaf-like specimen is about 4 cm. long (breadth unknown), the ear-shaped colony is about 3 cm. wide; the wall-shaped, which resembles Duchassaing & Michelotti's figure of *B. palma christi*, is 2 cm. long and 1.5 cm. high, and the rod-shaped, with the thickened terminal part, is 4 cm. high.

The color in all four specimens is red, in agreement with Duchassaing & Michelotti's description of both their forms. The spicules are chiefly red, and most of them resemble the branched forms which occur in the central part of the typical form.

It seems very likely that *B. asbestinum* begins with chiefly red, branched spicules which later become the characteristic spicules of the "axis," and that the more simple rods develop still later. It may be, however, that we have a separate variety with smaller colonies.

Genus 4. Paragorgia Milne-Edwards 1857

Diagnosis, from Kükenthal, 1919, p. 76: — Colonies vertically growing, branching chiefly in one plane, with cylindrical thick stem and with branches which often are developed as short, thick lobes. Zooids irregularly distributed, sometimes leaving one side free. They are retractile in the broad verrucae which may contract completely, leaving an eight-rayed star on the surface. The walls of the autozooids contain eight rows of small, double crosses, which continue onto the back of the tentacles. Dimorphism always developed. The minute siphonozooids have no tentacles and do not protrude above the surface. They contain the eggs and sperm. The cortex contains two layers. The thin outer layer contains no soleniae and is filled with small double crosses. The deeper layer, however, contains a circle of solenia and has spindle-shaped deposits with large spines. The medulla is not sharply defined and is perforated by numerous soleniae. It contains still larger rods or spindles. Color red or yellow.

Type species: — *P. arborea* L. (Edw. & Haime).

Remarks: — Kükenthal lists the type species and two doubtful forms. North Atlantic, Pacific, and Indian-Ocean; deep littoral to abyssal forms.

Paragorgia arborea (Linnaeus)

Pl. 5, figs. 20–22

Alcyonium arboreum Linnaeus, 1758, p. 803.

Paragorgia arborea Kükenthal, 1924, p. 28, text fig. 21 (complete list of references).—Verrill, 1922, p. 17, pl. **13**; pl. **14**, fig. 1, text-fig. 1.

This tall and striking species has been described in great detail by Kükenthal, 1919, p. 77.

Type: — Probably lost.

Type locality: — Northern Seas.

Distribution: — Widespread in the Northern Atlantic both along the European and North American coasts; also recorded from the North Pacific. (See Kükenthal, 1924, p. 29).

Depth: — Deep litoral, coast abyssal.

Specimens examined: — Several fragments from off Norway and from off Georges Bank; M.C.Z. cat. nos. 4201–4202.

Remarks: — According to Verrill this species is common off the fishing banks off Nova Scotia, Newfoundland, etc; material in U.N.S.M. It is not known how far south it ranges.

Genus 5. Iciligorgia Duchassaing 1870

For list of references, etc., see Kükenthal, 1916, p. 483; 1919, p. 101; 1924, p. 38.

Diagnosis, from Kükenthal, 1919, p. 479–483: — Colony tree-like, branched in one plane, very brittle. Stem and branches flattened, with flat front-side, and more vaulted back-side. Zooids in two rows, one along each edge, and able to retract into the low verrucae. Spicules of the zooids large spindles, with widely separated spines, and arranged in eight chevrons. The thin coenenchyma contains slender spindles with large rounded warts. The central core is closely packed with long, needle-like rods. Solenia seem absent in the central core, being present only in the deeper layer of the cortex. Color brownish.

Type species: — *Iciligorgia schrammi* Duchassaing.

Remarks: — The type species is known from the West Indies.

A new species is reported by Aurivillius from Bonin Islands (1931, p. 11, text fig. 1.)

Iciligorgia schrammi Duchassaing

Pl. 5, figs. 3–5

Iciligorgia schrammi Duchassaing, 1870, p. 12. — Kükenthal, 1924, p. 39.

Iciligorgia ballini Kükenthal, 1908, p. 479, pl. 23, fig. 3, text figs. L, M, N; 1924, p. 38 (complete list of literature).

Diagnosis: — See diagnosis for genus.

Type: — Probably lost.

Type locality: — Off Guadeloupe, 100 m.

Distribution: — Off Guadeloupe; Montserrat; Dominica; Virgin Islands, Tortugas. Probably widespread in the West Indies.

Depth: — From 10–50 fms.

Specimens examined: — A large dry fragment from off Tortugas, 10 fms. (Pourtalès Gulfstream Exploration); M.C.Z. cat. no. 4222. Smaller fragments from off Dominica and Montserrat, cat. nos. 4229, 4230.

Remarks: — Kükenthal bases his new species upon the fact that it has no solenia in the central part of the stem. What Duchassaing says is the case in *I. schrammi*, but this difference may probably be a mistake on Duchassaing's part. The present material shows distinctly the solenia in the external layer but no definite canals in the inner part of the stem.

Genus 6. Titanideum Verrill 1863

For discussion, literature, etc., see Kükenthal, 1919, p. 81; 1924, p. 30.

Diagnosis, from Kükenthal, 1919, p. 81: — Colony unbranched, or sparingly dichotomously branched. The main stems are cylindrical and arise from a common base. The zooids have no rigid lower part and occur over the entire surface. The thick coenenchyma has no specially differentiated outer layer. The spicules are three-, four-, or multi-armed forms. Solenia are present only in the cortex of the branches. They are absent in the fairly well defined central portion which contains rod-like, long sclerites with a single outgrowth, and chiefly four-armed bodies which are embedded in the horny meshwork. Color red, the central part yellow-brown.

Type species: — *Titanideum suberosum* (Ellis & Solander).

Remarks: — The only certain species known is from shallow water off North Carolina. (*T. noduliferum* and *crustatum* Hargitt & Rogers, listed as doubtful forms by Kükenthal, 1924, p. 31, are synonyms of *Diodogorgia* (see p. 87)).

Titanideum suberosum (Ellis & Solander)

Pl. 5, figs. 6–10

For list of references see Kükenthal, 1916, p. 476, figs. J–K; 1919, p. 82; 1924, p. 30, text figs. 22–23.

The "Blake" collection contains two orange-colored thick branches about 7 cm. long and 4 mm. wide, slightly tapering, and with rounded tips. The zooids are completely retracted into very low, flattened verrucae which open through

an oblong star-shaped pore. The zooids reach almost to the medulla, and are irregularly distributed over the surface.

The coenenchyma is orange-colored, the deeper layer more reddish. The medulla, which contains a large amount of horny substance, is brownish. The zooids are pale yellow.

There is a ring of solenia in the outer part of the coenenchyma and also a ring in the deeper layer, close to the medulla.

The coenenchyma contains numerous three-armed bodies with warts arranged in cauliflower-like clusters at the end and sometimes at the base of the arms. In addition there are four-, five- and more armed bodies of similar type but larger. The tentacles contain no spicules whatever. The medulla contains a great number of parallel rods with smooth slender shafts and a few short terminal projections composed of small clusters of spines.

The smallest bodies are about 0.04 mm. in diameter; the largest rods in the medulla may be as long as 0.2 mm.

Type and Type locality: — I have not been able to find in what collection the type is preserved or the locality and depth at which it was taken, as I have not seen Ellis & Solander's paper. Kükenthal's description is based upon a specimen in the M.C.Z. from Carolina; Verrill, 1863, p. 39, lists the species from off Charleston and Beaufort.

Specimens examined: — "Bache" Exp. South of Garden Key, Florida, 63 fms., 1 whole specimen (M.C.Z. cat. no. 4218).

"Blake" Exp., no locality nor depth; 2 fragments (M.C.Z. cat. no 4217). Also, some colonies from Charleston and Beaufort, collected by L. Agassiz, J. W. Page, and W. Stimpson.

Note: — Other species from the Atlantic Ocean.

Titanideum obscurum Thomson

Titanideum obscurum Thomson, 1927, p. 17, pl. 3, fig. 10; pl. 4; fig. 22; pl. 5, fig. 26.

Described as a new species from deep water (1250 m.) off the Azores. Its position seems uncertain.

It is colorless and distinctly different from *T. suberosum*, as one would expect from the fact that it is a deep water form. It may, however, be expected from deep water in the West Indian region.

[*Titanideum hartmeyeri* Kükenthal, (1908, p. 19) which Thomson mentions on p. 18, is a synonym of *Briareum asbestinum*. See Kükenthal, 1924, p. 16.]

7. Suberia Studer 1878

Diagnosis: — Unbranched Scleraxonians; colonies clubshaped with membranaceous base. Zooids large, scattered over the whole stem, anthocodia is practically free from spicules and can be retracted into the lower part which is filled with spicules. The central part of the axis consists of horny fibers and slender rods, the outer layer of short rods with warts arranged in girdles.

Type species: — *S. clavaria* Studer.

Remarks: — Two species are known, one is known from shallow water in South America, one from South Africa. The former occurs in the Brazilian waters.

1. Suberia clavaria Studer

Suberia clavaria Studer, 1878, p. 667, pl. 5, fig. 38 a, b. — Kükenthal 1924, p. 33, text figs. 24–25 (complete list of references).

This species which hitherto has been known from the east cost of Patagonia and Uruguay was discovered also to occur in the vicinity of Rio de Janeiro. Three specimens, in the Br. M., have been examined, and seem to agree in all respects with Studer's and Kükenthal careful descriptions.

Spongioderma Kölliker 1870

Diagnosis, see Kükenthal, 1919, p. 90.

Type species: — *Spongioderma verrucosa* (Möb.)

Two littoral species from South Africa, besides a doubtful form. See Kükenthal, 1924, pp. 34–36.

Genus 8. Diodogorgia Kükenthal 1919

Diagnosis, from Kükenthal, 1919. p. 96: — Colony vertical, branching tree-like, branches almost in one plane; distal end of branches swollen. The zooids are small and able to retract completely into the conical verrucae which are distributed over the colony, rather widely apart, especially on the stem. The retractile part of the zooid is filled with small, low-warted rods and derivatives of these. The coenenchyma contains oval, thick spindles with large warts arranged in girdles. In the deeper portion of the coenenchyma there are longer rods with more isolated tufts of warts. The medulla contains a closely-packed mixture of long rods with a few projections, and also irregular forms. The spicules

in the medulla are surrounded by a thick horny meshwork, which occasionally may become fused to and give rise to an apparent partial development of a horny axis. The medulla contains no solenia, but two concentric circles are present in the cortex.

Type Species: — *Diodogorgia ceratosa* Kükenthal.

Distribution: — Exclusively West Indian forms.

Key to the species of Diodogorgia

Spicules in the cortex as sparingly warted rods in combination with numerous three- to five-armed stars.....1. *Diodogorgia ceratosa* Kükenthal.
Spicules in the cortex as strongly warted spindles and relatively few stars.....
2. *Diodogorgia nodulifera* (Hargitt & Rogers).

1. Diodogorgia ceratosa Kükenthal

Diodogorgia ceratosa Kükenthal, 1919, p. 97; 1924, p. 36, text fig. 29.

The specimen in the M.C.Z. is much larger than the type described by Kükenthal. It is about 25 cm. in height exclusive of the base; the stem and upward bent, knarled branches measure about 1 cm. in thickness. The zooids are more crowded than in the other species, especially toward the swollen tips of the branches. The retracted zooids either form conical verrucae or they are completely retracted to the level of the surface.

The color is dark red, peculiarly faded in some parts; the anthocodiae are bright yellow. Most of the spicules are red; those in the anthocodia are yellow.

The spicules in the medulla are slender, sparingly branched rods, as much as 0.40 mm. in length, and easily liberated when treated with chemicals. The cortex and the zooids contain a dense layer of short warted rods in addition to numerous irregular crosses and stars, 0.05 mm. in length.

Type: — Probably in Berlin.

Type locality: — Gulf of Mexico.

Distribution: — At present known only from the type locality, and off Cumana, Venezuela.

Specimens examined: — A large colony from Venezuela, M.C.Z. cat. no. 4205, and some small fragments, most likely from the same place.

Remarks: — Our specimens agree closely with Kükenthal's description and with his figures of the spicules. Some of the branches are almost as slender as those

in his figure while others are much more robust. The zooids are also often completely retractile, whereas his figure of the type shows distinct conical verrucae.

2. Diodogorgia nodulifera (Hargitt & Rogers)

Pl. 5, figs. 11–19

Solandria nodulifera Hargitt & Rogers, 1901, p. 279, fig. C1.
Solandria crustata Hargitt & Rogers, 1901, p. 280, fig. C3.
Diodogorgia cervicornis Kükenthal, 1919, p. 645; 1924, p. 38.

Most of the colonies are considerably broken, but the best preserved fragments show that it is a slender, irregularly branching form with scattered conical verrucae, more crowded toward the swollen tips of the branches. The largest colony measures about 10 cm. in height, with a stem which is 5 mm. wide, and branches 2–3 mm. wide. One colony is incrusting, covering a horny tube, which is transversely striated — probably a worm tube, as Hargitt & Rogers' figure also seems to indicate.

The color varies from orange, to orange with a red inner layer and yellow zooids in the branching forms; the incrusting form is pure sulphur-yellow.

The spicules in the medulla consist of long, sparingly branched, interlaced rods of a glassy consistency, easily broken. They seem to be about 0.5 mm. in length. The cortex contains numerous, long, strongly warted spindles, 0.25–0.35 mm. in length, in addition to a number of smaller, star-shaped deposits. In the lower part of the zooids there are numerous spindles, and in the upper retractile part, small stars and rods, 0.05–0.10 mm. in length.

Type: — Evidently lost; at least, not in the U.S.N.M.

Type locality: — Off Porto Rico.

Distribution: — Off Florida, Porto Rico, Montserrat; shallow water to depths of about thirty fathoms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Station*	*Depth (fms.)*	*Locality*	*Specimens*
4227	9	37	Off Florida	Fragments
4225	12	42	" "	"
4224	127	38	" St. Croix	"
4226	155	88	" Montserrat	Incrusting form
4233	155	88	" "	Fragments

Pourtalès Gulf Stream Explor.

4223	W. of Tortugas in 35 fms.	Fragments
4228	Great Bahamas Bank in 35 fms.	Fragments

Remarks:—Kükenthal gives no figures illustrating this species, but the description of the outer features, the scattered, tall, conical verrucae, and the strongly warted spindles make it appear amost certain that the present species is identical with his *Diodogorgia cervicornis*. Some of the spindles are slightly larger than his measurements indicate, and they are therefore more in agreement with the measurements given by Hargitt & Rogers. I feel convinced that the two forms described by the latter authors are the same, especially since the present material contains both an incrusting form on a striated tube, as the two authors figure it, and an erect colony, from the same lot.

Note: — *Sclerogorgia mexicana* v. Koch is listed by Kükenthal, 1924, p. 45 as *Suberogorgia*. In 1919 he expresses his doubts about its position. Aurivillius 1931, p. 18 suggests it is a *Diodogorgia*. It seems most likely that it is *D. ceratosa*. The original specimen was labelled "Mexico."

Family 2. SUBEROGORGIIDAE

See Kükenthal, 1924, p. 40.

The family contains two genera which hitherto have been known only from the Indo-Pacific. One genus is here reported for the first time from the Atlantic Ocean.

Key to the Genera

1. Horny substance equally distributed in the axis ..... *Suberogorgia*.
1. Horny substance in an inner tube, and as fibers between the outer calcareous parts of the axis ..... 1. *Kerocides*.

1. Keroeides Wright & Studer 1887

Diagnosis: — Branched forms; axis with an inner horny central axis and an outer layer of sclerites united by their projections and surrounded by a horny substance. Zooids scattered, mostly lateral on the branches, and retractile to low verrucae. Sclerites in the zooids as spinous spindles which form a crown. Coenenchyma with large warty spindles, with flat disk-shaped sclerites, or with irregular forms.

Type species: — *Keroeides koreni* Wright & Studer.

Remarks: — The genus was established for a species *K. koreni* described by Wright & Studer, 1889, from several localities in the Indo-Pacific. The Blake Expedition however, secured a closely related form from the West Indies and

examination has shown that this form undoubtedly is identical with a species described by Lamouroux, in 1812, as *Gorgonia richardii*, and later figured by Duchassaing & Michelotti, in 1860. It has hitherto been regarded as a doubtful form, although Duchassaing & Michelotti mention that it is common in the West Indies. The present material agrees well with the original description, and one realizes when one examines the brittle fragments how little suited this species is to be preserved. It may be possible to get a complete specimen up on a fishing line but not with a dredge, and in dry condition the colony is very likely to be reduced to dust. That is undoubtedly the reason why no specimens seem to exist in the older collections.

Keroeides richardii (Lamouroux)

Gorgonia richardii Lamouroux, 1816, p. 407. — Duchassaing & Michelotti, 1860, p. 29, pl. 4, fig. 1; 1864, p. 18. — Verrill, 1869 d, p. 429.

In the collection are some fragments of a species which seems to belong to Wright & Studer's *Keroeides*. Nothing can be stated definitely about the size of the complete colony. There are some fragments of a stem (about 10 cm. high and 2 mm. thick) which formerly had a few branches. There are also some branches with alternate, pinnately arranged branchlets which carry a few scattered zooids, occurring alternatingly, and in one plane. The zooids are about 2 mm. high. Most likely they are able to retract into low verrucae, but in the present material they are well expanded and slightly trumpet-shaped. The spicules are arranged in indistinct longitudinal rows and continue over the back of the inward bent tentacles. The coenenchyma of the stem is covered with short thick rods with blunt warts on the outer side and longer, sometimes branched projections, on the inner side. The branches and branchlets are covered with slender pointed rods which are sparingly warted. The zooids contain similar rods, often thicker and slightly bent.

The axis is distinctly ribbed, and pale brown, almost white in color. The outer layer consists of horny fibers surrounding a close network of interlocked, smooth-surfaced spicules; their exact shape could not be determined. The inner part of the axis consists of a horny tube with thin, transverse septa. The color of the colony is whitish.

The blunt rods in the stem measure about 0.3–0.5 mm. in length and the rods in the branches and the zooids are about as large but more slender, the tentacles contain smaller rods.

Type: — Possibly in Paris.

Type locality: — "Antilles."

Distribution: — Seems to be common in the West Indies at moderate depth.

Depth: — From 73–150 fms.

Specimens examined: — Fragments from off St. Vincent, Guadeloupe and Barbados (Blake sta. 231, 164, 290); M.C.Z. cat. nos. 4234, 4237, 4235.

Remarks: — This species is the only Gorgonian known from the West Indies in which the stem may be described as having the consistence of soft, white wood. Lamouroux, description and Duchassaing & Michelotti's figure agree well with the fragments in the "Blake" collections. According to the two authors it is a common form in the West Indies and that agrees well with the "Blake" Expeditions results. Also the comparative low depth, 73–150 fms, at which it is taken, indicates that it is a species which it was possible to secure in earlier days with an ordinary fishing line. In fact that may explain why Lamoroux had large well preserved colonies, while modern expeditions with their dredges only get broken fragments.

It is impossible to say how closely related his form is to the species known from the Indo-Pacific. The spicules in the coenenchyma and zooids are stated to be much larger (2.4 mm.) in *K. koreni* than in *K. richardii.*

Family 3. CORALLIIDAE

For diagnosis, etc, see Kükenthal, 1924, p. 46.

Genus 1. Corallium Lamarck 1801

For diagnosis etc. see Kükenthal, 1924, p. 47.

The genus has 4 representatives in the eastern part of the Atlantic Ocean, all from deeper water, but none of these have been reported from the western part.

Family 4. MELITODIDAE

For diagnosis etc. see Kükenthal, 1924, pp. 53–88.

Indo-Pacific, littoral. A few species have been described from off South Africa.

Duchassaing, 1870, p. 18, reports *Melithaea occidentalis* from the West Indian waters but most likely it is an Isidid. (See p. 252).

Suborder HOLAXONIA

Family 5. PLEXAURIDAE

Diagnosis: — Colonies branching mostly in one plane, rarely bushy. The zooids occur on all sides of the branchlets and are always retractile. Verrucae may be present or lacking. The coenenchyma is thick and contains an inner layer of spicules either simple spindles or with girdles, and an outer layer with spicules of variable shapes. The central part of the axis is divided by transverse septa; the outer part is almost always loculated, and is either porous or it may contain incrusted lime. The longitudinal solenia are regularly arranged along the axis.

Indo-Pacific and Atlantic forms; mostly littoral.

Remarks: — The whole family has been treated by Kükenthal, 1924, pp. 89–139. For several of the West Indian genera Kunze has given extensive descriptions based upon first-hand study of material from that region, and Moser (1921, pp. 110–118) has revised the genus *Plexaura*. Five of the eleven genera occur in the West Indian waters. A key has been given to these genera in the following pages, but as only one species was secured by the "Blake" Expedition and as the M.C.Z. possesses very few forms, the family has not been treated in detail. The reader is referred to Kükenthal's, Kunze's, and Moser's recent papers.

It is possible that a few forms occur both in Brazilian and West Indian waters. Some of Verrill's figures in his paper of 1912 seem to indicate this. It is not known whether any of the forms which occur in the eastern part of the Atlantic Ocean are identical with any of those known from the western part. No list has therefore been given, as it is impossible to estimate the correct number of species. For a list of the species names with their literature, reference should be made to Kükenthal's monograph of 1919, pp. 747–748.

Key to the West Indian genera of Plexauridae

1. The outer layer of spicules consists of balloon-shaped clubs ..... 1. *Eunicella.*
1. The outer layer of spicules contains no balloon-shaped clubs ..... 2.
2. No clubs present; two- to four-rayed butterfly-like spicules are present in the outer layer. 2. *Plexaurella.*
2. Clubs of various forms are present ..... 3.
3. Zooids with elevated verrucae ..... 3. *Eunicea.*
3. Zooids without elevated verrucae ..... 4.
4. In outer layer, deposits with spines developed on the outer side only .... 4. *Plexauropsis.*
4. In outer layer no deposits with spines on the outer side only ..... 5. *Plexaura.*

Genus 1. Eunicella Verrill, 1869

Diagnosis: — Plexauridae variously branching, most often in one plane. Zooids usually prominent; truncate-conic in expansion, verruciform in contraction and generally capable of complete retraction; the margin of the verrucae closes the aperture in a stellate form.

Coenenchyma and zooids are covered with an external layer of small, flask-shaped clubs, the larger blunt outer ends of which, crowded together at the surface, are smooth or slightly roughened, fluted, or grooved. Interior layer of the coenenchyma contains spindles, double spindles, double heads, or double cones.

Type species: — *Eunicella verrucosa* (Pallas).

Remarks: — Kükenthal (1919, p. 255) lists eight species from the Indo-Pacific and eastern Atlantic which he considers valid, and ten which he regards as doubtful; among the latter is the one which he hitherto thought was the only species of *Eunicella* known from the West Indies. He listed *E. tenuis* Verrill but he evidently overlooked the other species, *E. modesta* Verrill (1883, p. 39, pl. 2, figs. 3–3a).

Key to the species of Eunicella known from the West Indies

Balloon-shaped clubs often three-winged ..... 1. *E. tenuis* Verrill.
Balloon-shaped clubs absolutely smooth in their outer part ..... 2. *E. modesta* Verrill.

1. Eunicella tenuis Verrill

Eunicella tenuis, Verrill, 1869d, p. 426 — Kükenthal, 1919, p. 752; 1924, p. 139.

The colony is white, somewhat flabelliform, about 300 mm. high; densely branched, the ultimate branches subpinnate, giving rise to short, alternating branchlets, about 6 mm. apart. The latter are 7 to 15 mm. long, and 1.25 mm. in diameter, exclusive of the verrucae; the tips are dilated and bi-lobed. The verrucae are small, but prominent, conical in shape, unequally alternating on opposite sides of the branchlets; about their own diameters apart; height of the largest, about 1.25 mm.; diameter, 0.7 to 1 mm.

The spicules are white; the larger double spindles in the interior of the coenenchyma are slender, acute, with a wide median space, each half covered with rather widely separated small conical warts; those nearer the center are

larger and in whorls, the rest scattered, decreasing in size toward the ends; external clubs very small, short, rather broad; the larger end flattened, often winged, or triquetral, truncate or slightly rounded, usually with two or three slight teeth or serrations on each, but these are often wanting. The small end is surrounded by a close whorl of very small rough warts, and terminated by one to three small points or papillae.

The slender spindles and double spindles are 0.27 by 0.04 mm.; the external clubs 0.08 by 0.04 mm.

Type: — Possibly in Philadelphia; fragments in Yale University Museum.

Type locality: — West Indies (?).

Specimens examined: — Fragments of the type (M.C.Z. cat. no. 4557).

Remarks: — This is a well defined species which could easily be recognized if it were found again.

2. Eunicella modesta Verrill

Eunicella modesta Verrill, 1883, p. 39, pl. 2, figs. 3–3a.
? E. dubia Studer, 1890, p. 557; 1901, p. 50, pl. 8, figs. 5–6.
Kükenthal, 1924, p. 138. — Thomson, 1927, p. 50.

The type is small, white, rather sparingly and subdichotomously branched in one plane. The base is expanded, adhering to shells or similar objects. The main stem gives rise to a few branches of about its own size. They spread abruptly at the base, and then bend upward in a broad curve. From these in turn arise a few, rather long, ascending branchlets, mostly from the outer side.

The largest specimen is 120 mm. high and 65 mm. broad; diameter of the branches 2.5 to 3 mm. A smaller entire specimen is 75 mm. high, 85 mm. broad, and has twenty branches.

The entire surface is covered with the exposed, smooth, rounded outer ends of club-shaped or flask-shaped spicules, forming the outer layer; they give the surface an even, regularly and finely granulated appearance when seen under a lens.

The axis is round, horny, of a dark chestnut-brown color in the larger branches; soft and yellow in the smaller ones.

The zooids, in alcohol, are rather large, low, rounded verrucae, which form a close double row along each margin of the branches. They are mostly in contact, or nearly so, at their bases, but leave a narrow, irregular, barren zone along

the middle of the sides. The tentacles are entirely retracted, and the aperture is usually completely closed so that the summit of the verrucae is evenly rounded or shows only a slight indentation in the center.

When dry, the lower rigid part of its zooids is more prominent, and is rounded, verruciform; the coenenchyma appears shrunken between them, due to drying.

The flask-shaped clubs of the coenenchyma are remarkable for the smoothness and evenly rounded form of the outer end; at the inner end there is usually a single group of small warts; sometimes there is another whorl of warts a short distance higher up on the stalk. The clubs are mostly from 0.13 to 0.16 mm. in length and 0.03 to 0.05 mm. in breadth. There are also a few double-headed, warty spicules, about 0.15 by 0.07 mm., a few double cones and double spindles about 0.25 by 0.03 mm., and some simple, warty, fusiform spindles, usually acute at both ends, and more or less curved; the larger of these measure about 0.25 by 0.03 or 0.04 mm. Some of the flask-shaped clubs have the larger end bi-lobed; others are completely bi-lobed or twinned.

Type: — M.C.Z. cat. no. 4556.

Type locality: — Off the coast of South Carolina, in 337 fms. ("Blake" Sta. 318).

Specimens examined: — The type.

Remarks: — *E. modesta* is reported also from 324 fms. off Bahia Honda, Cuba (Pourtalès Gulf Stream Explor.); but that specimen has apparently been lost.

It seems very likely that the present species is identical with Studer's *E. dubia* from 1300 m. off the Azores. It has the same smooth clubs, about 0.14 mm. long and 0.042 mm. broad.

Note: — A number of species are known from the Mediterranean, off the coast of Africa, and off the Cape of Good Hope. See Kükenthal, 1924, pp. 133–139. One new species has been described by Thomson (1927, p. 50, pl. 6, fig. 2) from 91 m. off Cape Verde.

Genus 2. Plexaurella Valenciennes 1855

For diagnosis, etc., see Kükenthal, 1919, pp. 200, 748, and 832; 1924, p. 101. Kunze, 1916, pp. 553–586, pls. 27-28, text figs. A–Z and A′–D′ (detailed monograph). Exclusively West Indian forms. Kükenthal (1924) includes nine valid species, two varieties, and three uncertain species. Verrill (1912, p. 382) described six new species from the coast of Brazil. Their relation to the West Indian

forms cannot be ascertained without study of the material, but possibly some of them occur in both regions. The genus is not represented in the "Blake" collections.

Genus 3. Eunicea Lamouroux 1816

Syn. Muriceopsis Aurivillius, 1931, p. 114.

For diagnosis, etc. see Kükenthal, 1919, pp. 750, 789, 832; 1924, p. 118. The genus has been treated monographically by Kunze (1916, pp. 506–552, pls. **24–26**, text figs. A–X). It is strictly littoral and contains eleven certain species, known from the West Indies and Brazil. It is not represented in the "Blake" collection.

Remarks: — Aurivillius' new genus, *Muriceopsis*, is for the present placed as a synonym of *Eunicea* and removed from the Muriceidae. He lists five species, four of these West Indian and Brazilian, and as far as one can ascertain, he has only examined one, from St. Bartholemew, called *M. tuberculata* (Esper), on Kölliker's authority. The other three species, from Brazil, are, *M. acropora* Verrill 1912, *M. bicolor* (Wright & Studer) 1889 and *M. humilis* (Milne-Edwards) 1857. Fragments of the types of *M. acropora* and *M. bicolor* have been examined, (Yale University and Br. M. respectively) and represent merely varieties of *Eunicea humilis*, the most common and most variable form in the Brazilian waters. The M.C.Z. has a large number of this shrubby little form. I doubt very much whether *M. tuberculata* from St. Bartholemew is distinct from *E. humilis*. (Aurivillius uses Esper's name on Kölliker's authority as Kölliker had access to Esper's collection, but Esper's figure shows a fan-shaped colony with short branchlets. The type had no locality but was probably Mediterranean; Esper, 1791, p. 128). Kükenthal places Esper's species under *Muricella*, among the doubtful forms.

Genus 4. Plexauropsis Verrill 1907

For diagnosis, etc. see Kükenthal, 1919, pp. 201, 213, 750, 789, 832; 1924, p. 118. One species, *P. bicolor* Verrill, is known only in shallow water off Bermuda. (Verrill, 1907, p. 309 pl. **33**B figs. 2b–c; pl. **35**, figs. 1–2).

Remarks: — Kükenthal does not seem to have examined any specimens of the type species.

Genus 5. Plexaura Lamouroux 1812

Diagnosis, from Kükenthal, 1924, p. 111: — Tree-like colonies laterally or dichotomously branching; bush-like, or with tendency to branch in one plane. The stem and branches are round, covered on all sides by crowded zooids which occasionally are arranged longitudinally. Verrucae always absent; zooids completely retractile into the cortex. Zooids with few or no spicules. In its outer part the thick cortex contains colorless spindles and rods, various kinds of clubs, and spinous spheres; no butterfly-shaped deposits are present. The inner cortex contains, beside colorless spicules, colored forms (mostly violet), such as spindles, and rods, the latter being sometimes curved. The innermost layer may contain red spicules. The axis is of a pure horny consistency.

Type species: — *Plexaura homomalla* Lamouroux.

Remarks: — Moser (1921) and Kükenthal (1924) list nineteen valid and two uncertain species, exclusively West Indian, shallow water forms. They are not represented in the "Blake" collections.

Family 6. MURICEIDAE

Plates **6–14**, **28–30**; **33**, figs. 2–3

Diagnosis, from Kükenthal, 1924, p. 139: — The colonies are mostly branching in one plane, often with anastomoses which may lead to reticulated forms. Sometimes the colonies are bush-like, or sparingly branched to unbranched. Zooids distributed over the entire surface, or absent on the back, or laterally placed. Verrucae in most cases higher than broad; operculum always present with spindles in the dorsal tentacle wall; usually also a collaret. Spicules of decidedly varying forms. Axis with transverse septa in the medulla; in most cases a loculated cortex.

Remarks: — Kükenthal (1924) lists twenty-seven valid genera, and a few have been added in the present paper. The family is very heterogeneous and may eventually be split up into smaller sub-families.

In most cases the stem is pale gray and fibrous, almost wood-like, but in some species it is dark brown and almost horny, resembling the kind one finds in the Gorgoniidae, which also seems to me to be a heterogeneous group. It is very likely that in the future some of the forms will be transferred from Gorgoniidae to Muriceidae, and vice versa.

Lately Aurivillius (1931, p. 94), has made a very careful contribution to

the study of this family. He is however mostly concerned with Indo-Pacific forms. It is beyond the limits of this paper to incorporate his viewpoints. Only the few West Indian species which he discusses are therefore mentioned below.

List of species of Muriceidae from the West Indies, Brazil, and the east coast of North America

Muricea laxa Verrill
M. muricata (Pallas)
M. spicifera Lamouroux
M. pendula Verrill
Eumuricea atlantica Riess
Hypnogorgia pendula Duchassaing & Michelotti
Caliacis nutans (Duchassaing & Michelotti)
Scleracis guadalupensis (Duchassaing & Michelotti)
S. petrosa spec. nov.
Thesea solitaria (Pourtalès)
T. granulosa spec. nov.
T. bicolor spec. nov.
T. rubra spec. nov.
T. gracilis spec. nov.
T. citrina spec. nov.
T. rugosa spec. nov.
T. parviflora spec. nov.
T. guadalupensis Duchassaing & Michelotti
T. grandiflora spec. nov.
T. nivea spec. nov.
T. hebes spec. nov.
T. plana spec. nov.
Bebryce cinerea spec. nov.
B. grandis spec. nov.
B. parastellata spec. nov.
Villogorgia nigrescens Duchassaing & Michelotti
Eubrandella flabellum (Verrill)
Acanthacis austera gen. et spec. nov.
A. scabra spec. nov.
Trachymuricea hirta gen. nov.
Paramuricea placomus (Linnaeus)

P. grandis Verrill
P. multispina spec. nov.
P. echinata spec. nov.
Placogorgia mirabilis spec. nov.
P. rudis spec. nov.
P. tenuis (Verrill)
Echinomuricea atlantica (Johnson)
Uncertain position: —
Filigella gracilis Gray
Anthomuricea antillarum Aurivillius

From the eastern Atlantic (including the Mediterranean Sea and the waters off the coast of Norway) Kükenthal (1924) lists thirteen deep water species. Four of these forms are closely related to those which occur in the West Indies. Thomson (1927) lists eighteen species, seven of which are identical with Kükenthal's forms and seven are new. One of these new forms seems to be represented in the "Blake" material. Thomson's nomenclature differs somewhat from that adopted by Kükenthal. He recognizes, for example, *Clematissa* which Kükenthal has merged into *Muriccides*, and he lists a number of *Echinomuricea*, a genus which Kükenthal regards as exclusively Indo-Pacific. Some of Thomson's species would apparently fit into Kükenthal's *Paramuricea* and *Placogorgia*.

Key to the Muriceidae known from the West Indian waters[1]

1. Spicules of various shape, i.e., spindles, grains, plates, cups and crosses, but never as thorn scales (projecting spindles with flattened expanded base) ..... 2.
1. Spicules as plates or spindles, often with outer central projection, and at least around the margin of the verrucae as thorn scales ..... 8.
2. Spicules as cups in the outer layer of the coenenchyma ..... 7. *Bebryce.*
2. Spicules as spindles or plates ..... 3.
3. Zooids placed on a shelf-like projection ..... 4.
3. Zooids not on shelf-like but with wart-like to tubular verrucae ..... 5.
4. Zooids crowded on all sides of the branchlets, resembling the needles of a conifer ..... 1. *Muricea.*
4. Zooids scattered, opposite or alternate ..... 3. *Hypnogorgia.*
5. Verrucae tube-like; spicules warted on inner side, spinous on outer side ... 2. *Eumuricea.*
5. Verrucae wart-like; spicules not differently developed on the outer and the inner side .. 6.
6. Spicules in a single layer, as large, closely fitting spindles; zooids small. 4. *Catiacis* gen. nov.
6. Spicules in double layer; zooids not remarkably small (compared to the deposits) ..... 7.

[1] Not included in the key are *Filigella* and *Anthomuricea*. See p. 147 and p. 148.

7. Spicules in outer layer, glass-like, transparent, as large spindles or plates . . . 5. *Scleracis.*
7. Spicules in outer layer not glass-like nor transparent; as grains, plates, or spindles . . . . . 6. *Thesea.*
8. Colonies regularly reticulated, fan-shaped, with oblong meshes; spicules as spindles and star-shaped bodies which, in the low verrucae, become thorn scales with a broad smooth spine . . . . . 8. *Eubrandella* nov. nom.
8. Colonies not regularly reticulated (a few branches may fuse) . . . . . 9.
9. Coenenchyma covered by a single layer of spindles or plates; zooids low, scattered, barely raised above the surface, with long projecting marginal spines . . . . 9. *Acanthacis* gen. nov.
9. Coenenchyma not with single layer of spindles or plates; usually a complete inner layer of smaller deposits of varying form; zooids raised above the surface, often flower-like, either scattered and relatively large, or small and crowded . . . . . 10.
10. Zooids large, scattered . . . . . 11.
10. Zooids small, more or less crowded . . . . . 12.
11. Zooids with numerous rows of spindles in the collaret and operculum . . . . . 10. *Trachymuricea* gen. nov.
11. Zooids with few rods of spindles in the collaret and operculum . . . . . 11. *Paramuricea* and 12. *Muriceides.*
12. Coenenchyma with four-armed bodies, with a columnar to coxcomb-shaped, central projection . . . . . 13. *Villogorgia.*
12. Coenenchyma with warted spindles . . . . . 13.
13. Thorn scales thin, with branched to lobate base and mostly blunt tip . . . . 14. *Placogorgia.*
13. Thorn scales thick, almost triangular in outline, and with pointed tip . 15. *Echinomuricea.*

Remarks: — The relationships and limits of the last two genera are not clear. Thomson and Kükenthal define their genera differently, and the descriptions are not complete enough to make it always evident when they are dealing with the same species. All these forms need a thorough revision, but it must be based on a first-hand study of the material, not on the literature. It seems to me that some of the species which Thomson lists in *Muriceides* could just as well be placed in *Paramuricea*, etc.

1. Muricea Lamouroux 1821

Diagnosis, partly from Riess, 1929, p. 384: — Colonies mostly tree-formed, dichotomously or laterally branching; zooids uniformly distributed. Anthostele with two lips, or with only a protruding, boat-shaped lower lip; operculum with a few simple spindles in the basal portion of the tentacles; collaret lacking or indistinct. Spicules in the anthostele, and in the outer layer of the coenenchyma, as large spindles with numerous warts; in the inner layer, as simple rods with a few blunt projections. Axis horny, flexible.

Color white, yellow to reddish-orange. Color contained in the spicules.

Type species: — *Muricea muricata* (Pallas).

Remarks: — In her revision of the genus Miss Riess lists fifteen valid species with three varieties, and three uncertain species. The genus is restricted to the West Indies and to the waters off the west coast of Central America; shallow water forms. See Kükenthal 1924, p. 141.

The "Blake" collections contain one small fragment. Revision of the material in the M.C.Z. has shown that there seem to be four valid species which can be recognized in the West Indian region.

Key to the species of Muricea from the West Indian region

1. The colonies branch pinnately; branchlets drooping. Large spicules with erect blunt spines ..... 4. *Muricea pendula* Verrill.
1. The colonies branch dichotomously; branchlets not drooping ..... 2.
2. Branches and axis flattened; distinct "wings" on the horny stem where the branches are given off. No rows of comb-like spines on the large spicules .. 3. *M. spicifera* Lamouroux.
2. Branches and axis cylindrical; no distinct "wings" on the horny stem where the branches are given off ..... 3.
3. Spicules as spindles; with numerous smooth thick spines on the distal part; verrucae crowded ..... 1. *M. muricata* (Pallas).
3. Spicules as spindles with one single smooth thick spine on the distal part; verrucae not crowded ..... 2. *M. laxa* Verrill.

1. Muricea muricata (Pallas)

Plate 6, fig. 1; plate 9, figs. 1–3

For literature see Kükenthal, 1924, p. 142. — Riess, 1929, p. 391.
Muricea elongata Lamouroux, 1821, p. 37. — Aurivillius, 1931, p. 105, text fig. 20.

The M.C.Z. collection contains about half a dozen specimens of this common form. It reaches in general a height of 45 cm. and a similar breadth. Some of the specimens are taller and narrower. The main stem is short and gives off several strong branches which in turn branch dichotomously in one plane, usually in such a manner that one gets the impression that the branchlets all arise from the upper side of the branch. The branchlets are about 5 mm. wide.

The verrucae are numerous, crowded, and obliquely appressed. The operculum is small and usually retracted. Between the verrucae large spindles are superficially placed. The coenenchyma is relatively thick with a distinct inner layer of small spicules.

The color of the dry colonies is yellow or white. The axis is brown, horny, flexible, and cylindrical in cross section, and there are only very faint indications of "wings" in the angles of the branches.

The spicules in the lower lip and in the outer layer of the coenenchyma are spindles with a number of large, obliquely placed teeth on the outer side. The rest of the spicules are covered by low complicated warts. The larger spindles between the verrucae are covered regularly by complicated warts on all sides. The spicules in the inner layer of the coenenchyma are simple rods, or short capstans with a few blunt projections.

The spicules with the long spines vary between 0.3 and 0.8 mm. in length. The large, regularly warted spindles may be as long as 1.3 mm.; the simple spicules in the inner layer as long as 0.15 mm.

Type: — Possibly in some European Museum.

Type locality: — "Mare Americanum."

Distribution: — The species seems to be common in shallow water in the West Indies and occurs also in the Bermudas.

Specimens examined: — Six specimens collected off Florida and one off Havana (M.C.Z. cat. nos. 4564–65).

Remarks: — The more slender specimens were labelled *Muricea elongata* Lam., but I do not think that that species can be maintained.

2. Muricea laxa Verrill

Plate 9, figs. 4–8; plate 28, figs. 1, 1a

Muricea laxa Verrill, 1864, p. 36. — Kükenthal, 1924, p. 144. — Riess, 1929, p. 388.

The M.C.Z. possesses two specimens, one of which is the type. These colonies are 25–30 cm. high, are less distinctly fan-shaped than *M. muricata*, and have longer, more flexible branchlets, usually 3–4 mm. wide. The anthosteles have a more projecting lower lip and are more sparingly distributed than in *M. muricata*. The spicules differ from those in the latter species by having a simple smooth terminal tooth, varying in development. Otherwise, the spicules are of the same type and size.

Type: — M.C.Z. cat. no. 4570.

Type locality: — Off Florida, in shallow water.

Specimens examined: — Two specimens, both from Florida, one of which is the type.

Remarks: — This species is easily distinguished from *M. muricata* when the spicules of both forms are examined and compared. It is very likely that *M. laxa* is quite common throughout the West Indian region, but it has apparently often been confused with *M. muricata*.

3. Muricea spicifera Lamouroux

Plate 9, figs. 9–11

Muricea spicifera Lamouroux, 1821, p. 36, pl. 71, figs. 1–2. — Duchassaing & Michelotti, 1860, p. 19. — Verrill, 1864, p. 36.

Gorgonia muricata (partim.) Pallas, 1766, p. 198.

The colonies are 30–40 cm. high and branch mostly as a fan, with two or more main stems diverging near the base. The branching is dichotomous but unequal; the outer part of the fork is usually thicker, and lies in the continuation of the foregoing joint. The zooids are crowded, and bent upward. The tentacles, with the small operculum, are often completely withdrawn. There are a few but large spindles in the lower lip; the coenenchyma is covered by similar spindles, and at intervals exceptionally large spindles, superficially placed, are found. Smaller deposits form an inner layer.

The axis is dark brown, horny, paler distally, and shows a distinct tendency to become flattened and form "wings" when the tissue is removed. The color of the colony in a dry condition varies from almost white to pale orange and is incorporated in the spicules.

The spindles in the outer layer and in the verrucae are uniformly warted and have no rows of comb-like teeth. The inner layer consists of much shorter spindles, with a few simple warts, and of capstan-like deposits.

One colony examined contained large, apparently almost ripe eggs about 0.40 mm. in diameter.

Type: — Possibly in Paris.

Type locality: — West Indies.

Distribution: — The M.C.Z. has material collected off Havana, Dry Tortugas, Florida, and Guadeloupe (M.C.Z. cat. nos. 4566–69); possibly much more widely spread. There is no certain record of its occurrence in Bermuda. Shallow water form.

Remarks: — This species seems to have been entirely overlooked ever since 1869, when Verrill mentioned it. In most cases it has been placed as a synonym of *M. muricata* (see Riess, 1929, p. 301 [as *spinifera*]).

It seems quite evident that this form should be kept as a separate species. Duchassaing & Michelotti remark: "cette espèce se reconnait assez facilement á ses rameaux assez gros et comprimés." Esper gave an excellent figure of this species (1788–94, pl. 8, Gorgonia).

4. Muricea pendula Verrill

Place 9, figs. 12–14

Muricea elegans L. Ag. MS., Verrill, 1863, p. 9; Verrill, 1864, p. 36.

M. pendula Verrill, 1868a, p. 412, 1864a, p. 45.

Non *M. pendula* Riess, 1929, p. 385, pl. 8, fig. 1 (possibly *M. laxa*, according to the figures). — Kükenthal, 1924, p. 144.

The M.C.Z. possesses two specimens, both designated as the type. They are about 50–60 cm. high, with a single stem from which arise large flexible branches, alternatingly, in the same plane, and these in turn give off short branchlets. The stem is about 1 cm. thick near the base, the branchlets measure as much as 3–4 mm. in thickness. The zooids are not very crowded; the lower lip is long and projecting. On the stem the zooids are scattered.

The axis is dark brown, horny, and cylindrical. The color of the dry colony is orange, due to the coloration of the spicules.

The spicules are large, thick spindles with erect, blunt spines on the outer side and composite warts on the inner side; smaller spindles, with composite warts all over the surface, are intermingled with the larger spindles. The inner layer usually contains short rods and capstans with a few, blunt projections.

The small operculum, which is often contracted, is composed of warted spindles arranged in pairs in each division. The outer divisions have somewhat larger spindles. No collaret seems to be present.

The large spindles, which occur between the zooids, measure about 1 mm. in length; the large spindles in the lower lip 0.8 mm., and the smaller inner spindles between 0.15–0.20 mm. in length.

Type: — M.C.Z. cat. no. 4558.

Type locality: — Off the bar at Charleston, S. C.

Distribution: — At present known only from the type locality.

Specimens examined: — The type, and a poorly preserved colony from the same locality (M.C.Z. cat. no. 4561).

Remarks: — As Verrill pointed out, the present species differs from the others known from Florida, by its long drooping branches and its pinnate mode

of branching; the three other forms are distinctly dichotomously branched. The name *elegans* (Ag. MS.), used in the two first papers, was superseded by *pendula*, because *elegans* was pre-occupied.

2. Eumuricea Verrill 1868

Diagnosis, from Kükenthal, 1924, p. 149: — Colonies branching tree-like, and dichotomously, sometimes almost in one plane. Branches and branchlets upward bending, almost parallel, and of about equal thickness, with slightly thickened ends. Zooids crowded all over the surface, at right angles to the stem or slightly bent upwards. Verrucae long, slender, and cylindrical, somewhat enlarged at the distal end. In the verrucae, as well as in the thick coenenchyma, there are large spindles, with one or both ends pointed, and with conical spines on the outer and low composite warts on the inner side. The spicules may overlap in the verrucae, but they never form converging double rows.

Type species: — *Eumuricea acervata* Verrill.

Remarks: — Kükenthal (1924) lists several species, mostly from the west coast of Central America. A single species has been described from the West Indies. It is not in the "Blake" collection nor in those at the M.C.Z.

1. Eumuricea atlantica Riess

Eumuricea atlantica Riess, in Kükenthal's monograph, 1919, p. 907; 1929, p. 399, pl. 8, fig. 4. — Kükenthal, 1924, p. 152.

From Riess' description and figure it is evident that this species forms fan-shaped colonies, often several fans parallel to each other, arising from a short main stem, and that the branches and branchlets are long, upward bent and slightly tapering. The type measures 28 cm. in height and is 23 cm. wide. The zooids are crowded with a shorter or longer anthostele and the anthocodia has a few warted spindles in the base of the tentacles. The spicules in the outer layer are large spindles, up to 1.8 mm. in length, with spines on the outer side and warts on the inner and often the lower end blunt. In the inner layer the spicules are 0.55 mm. long and have few broad spines. The color ranges from yellow brown to dark brown.

Type: — Museum of Münich.

Type locality: — Off Tortugas.

Distribution: — Off Tortugas and Kingston, Jamaica.

Depth: — Shallow water.

Specimens examined: — None.

Remarks: — It is peculiar that this species has never been reported by others from the well explored Tortugas region; it is possible that it belongs to one of the forms which superficially resembles a Plexaurid.

Note: — Thomson, 1927, lists two species from the eastern Atlantic, both as new, viz., *Eumuricea rugosa* Thomson, p. 48, pl. 1, figs. 2, 11; pl. 5, fig. 16, and *Eumuricea rigida* Thomson, p. 48, pl. 13, figs. 17, 22. I doubt very much whether they belong to this genus as it is defined by Riess and Kükenthal.

3. Hypnogorgia Duchassaing & Michelotti 1864

Diagnosis: — Colony upright, loosely branched with soft slender branchlets. Zooids laterally placed in alternating rows, with a narrow lower lip and a high operculum, of unequally long spindles, which is bent inward. Spicules as long spinous spindles.

Type species: — *Hypnogorgia pendula* Duch. & Mich.

Remarks: — Aside from the original description and the diagnosis included in Hargitt and Rogers' paper of 1901, as well as that in Kükenthal's last paper (1924, p. 237), I have been unable to find any other references to this genus. In Verrill's notes the species is placed in a new genus. A single jar, however, which has no catalogue number, bears a faded inscription — "Hypnogorgia pendula," on one of the "Blake" expedition labels.

It is quite evident that the species is identical with the one which Duchassaing & Michelotti examined, although the figures they give are rather indefinite.

Hypnogorgia pendula Duchassaing & Michelotti

Pl. 6, fig. 3; pl. 12, figs. 23–24; pl. 33, fig. 2

Hypnogorgia pendula Duchassaing & Michelotti, 1864, p. 21, pl. 5, figs. 1–2. — Kükenthal, 1924, p. 237.

From the two authors' figures, the species evidently grows to quite a large size. The largest, broken specimen in the "Blake" collection appears to have been about 50 cm. high.

The colony has one or more strong main stems which give off slender

branches, alternatingly or opposite, with intervals of about 1 cm., and these branches often give off branchlets in the same way. The branching is strictly in one plane. The zooids are laterally placed, alternating, and consist of a narrow bracket-like lower lip and a tall oblique operculum which is sharply bent inward.

The color of the colony is white or pinkish; the axis black and horny in the stem and pale yellow, soft, and flexible in the branches and branchlets.

The spicules consist of slender rods covered regularly with simple spines. The verrucae consist of a few long projecting rods in the lower lip, and much smaller ones on the sides and in the upper lip. The operculum carries about 4–5 large rods on its outer side and some smaller ones on the inward-turned side. No collaret seems to be present. The tentacles contain a large number of rods of varying size, but their exact arrangement could not be ascertained. The coenenchyma contains long rods, mostly arranged lengthwise; sometimes they may be transversally placed at the base of a verrucae. The largest spindles average about 2 mm.

Type: — Probably in Museum of Turin.

Type locality: — Off Guadeloupe; no record of depth.

Distribution: — West Indies, in about 75–100 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4696	155	88	Off Montserrat	1 large
4697	203	96	" Martinique	1 small
4698	290	73	" Barbados	1 small
4699	No locality			1 large
4700	"Antilles," a fragment, sent from the Museum in Turin.			

4. Caliacis gen. nov.

Syn. Thesea (partim) Duchassaing & Michelotti, 1864, p. 15.

Diagnosis: — Corallium branched with slender branchlets. Verrucae small, arranged on the branches in two rows, closer to one side, thus dividing the surface of the branches into a wide and a narrow longitudinal band. Coenenchyma thin, covered by a single layer of very large elongated spicules. Verrucae small, only slightly raised, and almost hidden between the bands of heavy spicules. Spicules elongated, simple, warted spindles, occurring in a single layer.

Type species: — *Caliacis nutans* (Duchassaing & Michelotti).

1. Caliacis nutans (Duchassaing & Michelotti)

Plate 6, fig. 2

Thesea nutans Duchassaing & Michelotti, 1864, p. 15, pl. 3, figs. 1–2. — Kükenthal, 1924, p. 154.

The largest colony in the collection is branched and 20 cm. high; there is also a small specimen, 5 cm. high, and a branch 2–3 cm. long. It is a loosely-branching form with widely diverging, forked branches and long upward bending branchlets. The verrucae are small, insignificant, and laterally placed, somewhat closer to the front side. The coenenchyma is filled with very long, slender, warted spindles, mostly arranged length-wise.

The color of the colony is white or greyish, the axis is brown.

The spicules consist of a single layer of long, regularly warted spindles, as much as 4 mm. in length. The verrucae contain much smaller spindles which sometimes seem to project, but that effect may be due to the preparation. The operculum contains one pair of warted spindles in each section; the collaret, 2–3 transverse rows of curved spindles.

Type: — Possibly in Museum of Turin.

Type locality: — Off Guadeloupe, in deeper water.

Specimens examined: — One large colony from 94 fms. off Barbados. ("Blake" Sta. 276), a small colony and a fragment from the same water in 72 fms. and 100 fms. ("Blake" Sta. 190, and "Hassler" Exp.); M.C.Z. cat. nos. 4572–74.

Remarks: — The species is extremely striking on account of its long spindles and the diminutive verrucae. Duchassaing & Michelotti give quite a good illustration of the entire colony, evidently figured from the back. The contracted, dry zooids may be almost black, as the two authors describe them. Their specimen was reddish, but if the color was incorporated in the tissue it would certainly fade in the course of time. The species does not appear to have been again reported since the type was collected.

Scleracis Riess 1919

Syn. Acis Duchassaing & Michelotti, 1860. (Nec *Acis* Billberg, 1820, Lesson 1830.)

Diagnosis: — Colonies branching in one plane, both laterally and dichotomously. Zooids vertically placed, as high as 2 mm., laterally and in alternating rows. Operculum with double rows of spindles, slightly warted. Coenenchyma with two layers: an outermost layer of large spindles or plates fitting closely

together, glass-like, in moist condition; innermost, a layer of sparingly warted, smaller spindles.

Type species: — *Scleracis guadalupensis* (Duchassaing & Michelotti).

Remarks: — This genus was described briefly by Riess, 1919, in Kükenthal's monograph p. 837, based upon a species from the collections in the M.C.Z., (labelled tentatively *S. pumila* by Verrill). Examination of the type of *Acis guadeloupensis* in Br. M., however, revealed that Riess' *Scleracis pumila* is a synonym of *guadeloupensis*. I doubt very much whether the genus can actually be kept separate from the Indo-Pacific genus, *Paracis* Kükenthal (1919, p. 837; 1924, p. 154).

The "Blake" collection contains a large number of the type species and also one new species.

Key to the species of Scleracis

Spicules as flat scales ..... 2. *S. petrosa* spec. nov.
Spicules as spindles ..... 1. *S. guadaloupensis* (Duchassaing & Michelotti).

1. Scleracis guadaloupensis (Duchassaing & Michelotti)

Plate 6, figs. 5–7

Acis guadaloupensis Duchassaing & Michelotti, 1860, p. 20, pl. 1, figs. 14, 15.
Scleracis pumila Riess, in Kükenthal, 1919, p. 908; Kükenthal, 1924, p. 161. — Riess, 1929, p. 405. pl. 8, fig. 6.
Thesea guadaloupensis, Kükenthal, 1924, p. 153.

The "Blake" collection contains a large number of this species, which has been described in great detail by Riess (1929).

Most of the colonies are small, 6–10 cm. high and often broader than high; they are fan-shaped, dichotomously branching, with stem and branches of about the same thickness, 1–2 mm. wide. The zooids are cylindrical, 1 mm. high, and mostly scattered along the edges, sometimes also on the front and back. The spicules in the outer layer of the coenenchyma are pointed, warted spindles with composite warts, and are translucent when moist. Those in the inner layer are small, with fewer warts. The spicules are smaller in the verrucae. The zooids have a distinct operculum with a few, curved rods.

The color of the colonies varies from white, dirty grey, pink to scarlet red. The axis is brown, paler in the branchlets, and fairly horny.

The outer spicules may be as long as 3.5 mm.; most of them average 1.–1.5

mm. in length. Those of the inner layer measure about 0.20 mm.; a few are longer. The rods in the operculum are about 0.20 mm. long.

Type: — Br. M.

Type locality: — Off Guadeloupe.

Distribution: — Widespread in the West Indies.

Depth: — From 42 to 191 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4575	45	101	Off Florida	8 (partly broken)
4578	155	88	" Montserrat	2
4579	163	163	" Cariacou	2
4583	210	191	" Martinique	1
4584	231	95	" St. Vincent	2
4585	241	163	" Grenada	4
4586	247	170	" "	1
4587	272	76	" Barbados	1
4588	273	103	" "	1
4589	276	94	" "	4
4590	292	56	" "	1
4591	No locality; "Blake" Expedition.			2
4592	Off Barbados, in 100 fms. ("Hassler" Expedition)			3
4593	Off Florida, in 42 fms. (Pourtalès Gulf Stream Expedition)			1
Pink form: —				
4594	Off Florida, in 42 fms. (Pourtalès Gulf Stream Expedition)			4
4595	" " in 68 fms. (Pourtalès Gulf Stream Expedition)			1

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
Scarlet-red form: —				
4596	203	96	Off Martinique	2
4597	231	95	" St. Vincent	1
4598	241	163	" Grenadines	1
4599	246	154	" Grenada	1
4600	247	170	" "	2
4601	276	94	" Barbados	2 fragments
4602	No locality; ("Blake" Expedition).			
4603	12	42	" Florida	1

Remarks: — The scarlet-red and white forms occur together; also the pink and white ones have been taken in the same locality.

The type is white and agrees in all respect with the specimens in the M.C.Z.

2. Scleracis petrosa spec. nov.

Plate 6, fig. 8

The colonies are about 8 cm. in height, rather rigid, irregularly branched in one plane; branchlets stout, thick, slightly flattened, usually crooked; the verrucae are prominent and in general laterally placed, not closely packed, irregularly alternate.

Axis brown, terminal branchlets yellow; central part distinctly divided into narrow compartments. Color in alcohol whitish; tentacles brown.

Coenenchyma covered by a glass-like, outer coat of large, unequal, mostly angular plates with the edges in close contact, so that they form a kind of irregular mosaic; some of the larger plates are half as broad as the branchlets are wide, or even more; some are longer than broad, others squarish, or trapezoidal, etc., and usually curved to fit the form of the branch. Large and smaller plates are intermixed. The inner layer is thin, with small, spinous spindles. The verrucae are covered by smaller plates, irregularly distributed. The operculum is small and insignificant, with about three small spicules placed in chevron.

Some of the larger plates may be as long as 2.00 by 0.92 mm. The spicules of the inner layer are much smaller and more regularly shaped spinous spindles.

Type: — M.C.Z. cat. no. 4576.

Type locality: — Off Morro Light, Cuba, in 175 fms. ("Blake" Sta. 101).

Distribution: — Off Cuba, Dry Tortugas, St. Croix, Guadeloupe, Martinique; usually in 150–200 fms.; one specimen from Guadeloupe was taken in 878 fms. (?).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4576	101	175	Off Morro Light, Cuba	1
4577	134	248	" St. Croix	1
4580	166	150	" Guadeloupe	1
4581	174	878	" "	1
4582	206	170	" Martinique	1

6. Thesea Duchassaing & Michelotti 1860

Syn. Evacis (*nomen nudum*) Verrill, 1912, p. 377.
Non *Thesea* Riess, 1929, p. 401.

Diagnosis: — Muriceidae, having slender to thick branchlets, and small to large verrucae with simple spindles in eight teeth around the orifice; with or

without collaret, and with a variable number of double rows of spindles in the operculum. Spicules in two layers in the coenenchyma: the outer layer composed of large globular to plate-like deposits or rods, often with the outer side undulated; the inner layer consists of warted spindles of various thickness and size. Axis brown, wood-like, fibrous.

Type species: — *Thesea guadalupensis* Duch. & Mich.

Remarks: — The diagnosis given in the present paper is based upon the revision of a fragment of the type which was found in the collection. It is difficult to be sure whether Miss Riess actually had a specimen of a true *Thesea* before her or not. I am inclined to think that her *Thesea guadalupensis* from 42 fms. off Tortugas (evidently one of Pourtalès' stations) is identical with "*Scleracis pumila* Riess" (see p. 108). The latter species occurred at that particular locality, both in the red and in the white variety, while no specimen of *Thesea* is present in the collection or has been described from those waters, and it is quite unlikely that the M.C.Z. should have turned all their material of an undescribed species over to Dr. Kükenthal. It is erroneously stated in her key, and also in Kükenthal's keys (1919 and 1924), that the coenenchyma contains one layer of spicules in *Thesea*, and that this character serves to distinguish it from *Scleracis*. In her description (p. 403), however, she says that there are two layers, which is true of both *Scleracis* and *Thesea*.

Kükenthal (1924, pp. 153–154) lists three species, two of which are treated in the following pages. The third, *T. nutans* Duch. & Mich., is *Calliacis nutans* (see p. 107).

The "Blake" material and the M.C.Z. collections contain in all twelve species. The genus is not known outside the West Indian region. A single species, *T. bicolor*, extends as far as Brazil (mentioned in Verrill's report of 1912).

Key to the species of Thesea

1. Colony unbranched; stem band-like, flattened. Zooids in a close row along the sides. Color white ..... 1. *T. solitaria* (Pourtalès).
1. Colony branched; stem not distinctly flattened. Zooids not in close rows, often scattered over entire surface ..... 2.
2. All or some of the spicules are red ..... 3.
2. None of the spicules are red ..... 6.
3. Spicules all red; outer layer with spherical deposits. Branchlets mostly short, sometimes coalescent ..... 2. *T. granulosa* spec. nov.
3. Spicules not all red ..... 4.
4. Spicules partly yellow ..... 3. *T. bicolor* spec. nov.

4. Spicules partly white, partly red.....5.
5. Spicules of the inner layer chiefly white; branchlets thick, swollen at the tip.....
4. *T. rubra* spec. nov.
5. Spicules of the outer layer white; branchlets slender.....5. *T. gracilis* spec. nov.
6. Spicules all orange colored. Slender form, with numerous long branches, 1–1.5 mm. wide.
6. *T. citrina* spec. nov.
6. Spicules orange and white, or white alone.....7.
7. Spicules partly orange. Colony sparingly branched.....7. *T. rugosa* spec. nov.
7. Spicules all white.....8.
8. Spicules in outer layer as grains or plates, double cones rare.....9.
8. Spicules in outer layer as grains or plates, double cones numerous.....10.
9. Colonies with long slender branches, about 1 mm. in diameter. Verrucae low, hardly raised above the surface.....8. *T. parviflora* spec. nov.
9. Colonies with strong thick branches about 2–2.5 mm. in diameter. Verrucae prominent, conical, raised above the surface.....9. *T. guadalupensis* Duchassaing & Michelotti.
10. Spicules in outer layer as more or less flattened plates.....10. *T. grandiflora* spec. nov.
10. Spicules in outer layer chiefly as rounded bodies.....11.
11. Spicules in outer layer of unequal size, not chiefly developed as double heads.....
11. *T. hebes* spec. nov.
11. Spicules in outer layer of fairly uniform size, mostly developed as double heads, and double cones, or as coarsely warted spindles.....12.
12. Branches in one plane. Spicules as double heads and double cones.12. *T. nivea* spec. nov.
12. Branches not in one plane. Spicules as double heads and simple spindles, coarsely warted.
13. *T. plana* spec. nov.

1. Thesea solitaria (Pourtalès)

Plate **7**, fig. 6; plate **11**, figs. 1–3

Acis solitaria Pourtales, 1868, p. 132.
Evacis solitaria Verrill, 1912, p. 377.
Thesea solitaria Kükenthal, 1924, p. 154. — Riess, 1929, p. 404.

This species is represented by a large number of colonies, invariably unbranched, with flattened stem, as much as 30 cm. high and 3–4 mm. wide. The zooids form a closely set row along the edge, often larger and smaller verrucae alternating in the row. If a zooid is placed on the front or on the back side, the position seems to be abnormal (due to injury). The tentacles in most individuals are completely retracted and the verrucinal opening is distinctly slitlike. The collaret contains 3–4 rows of flattened spindles; in the operculum there are numerous similar flattened spindles with dentated edges. The coenenchyma is covered by a close-fitting pavement composed chiefly of oblong, rhomboid plates.

The outer surface is enamel-like, glistening, with low knobs and ridges. In the verrucae these deposits become smaller, and spindles are present. The inner layer of the coenenchyma consists of small spindles, often club-shaped, with scattered groups of warts.

The color of the colony is white; the axis is brown, and also fibrous.

The large external plates may be as much as 0.95 mm. in length; the spindles in the inner as long as 0.35 mm.; the spindles in the operculum and collaret average about 0.30 mm.

Type: — M.C.Z. cat. no. 4618.

Type locality: — Off Cuba, in 125 fms.

Specimens examined: —

M.C.Z. Cat. No.	
4618	Off Cuba, in 125 fms., 1 specimen ("Bache" Exp.).
4619	" Sombrero Island, in 126 fms. 8 specimens ("Bache" Exp.).
4620	" Florida, in 152 fms., 4 specimens ("Bache" Exp.).
4621	" Sand Key, in 120 fms., 2 specimens ("Bache" Exp.).
4622	" Tennessee reef, in 174 fms., 1 specimen ("Bache" Exp.).
4623	" Tortugas, in 101 fms., 1 specimen ("Blake" Sta. 45).

Remarks: — Judging by the present material, the species seems to be extremely limited in distribution. It shows no close affinities to any of the other species.

2. Thesea granulosa spec. nov.

Plate **7**, fig. 5; plate **11**, figs. 24–26

There is one well-preserved colony and some fragments in the collection. The complete colony appears to be full-grown and measures 11 cm. in height and 10 cm. in breadth. It branches profusely in one plane with occasional anastomoses, and has several main branches and a large number of upward curved branchlets in alternating order. Most of the branchlets are short (1–2 cm. long and 1 mm. in diameter). The zooids are conical and mostly lateral in occurrence, somewhat more crowded on the front side. The branchlets are not swollen at the tips. The verrucinal opening is distinctly stellate. In most cases the operculum is completely contracted; in others it seems to have been torn off.

The color of the colony is red, the color being incorporated in the red spicules. The coenenchyma is relatively thin, and the axis is brown and fibrous.

The spicules in the outer layer of the coenenchyma consist of red warted grains of various size, rarely developed as double heads. The inner layer contains smaller, sparingly warted spindles which are also red; some of the smallest are, however, very pale. The spicules around the operculum contain a few pairs of roughly warted spindles arranged in chevrons, and a few transverse rows of similar curved spindles, also red, occur in the collaret.

The outer irregular grains are between 0.15 and 0.30 mm.; the inner spindles may be as long as 0.20–0.25 mm.; the opercular spindles as long as 0.40 mm.; those in the collaret, 0.50 mm.

Type: — M.C.Z. cat. no. 4624.

Type locality: — Off Cariacou, in 163 fms. ("Blake" Sta. 241).

Specimens examined: — The type, and some fragments from 263 fms. off Grenada ("Blake" Sta. 249), M.C.Z. cat. no. 4625.

Remarks: — This species differs from *Thesea rubra* by the abundance of short branchlets and by the total lack of colorless spindles in the thin inner layer.

3. Thesea bicolor spec. nov.

Plate 11, figs. 11–13

The type, which is the only specimen in the collection, is evidently young and has a simple stem with one short branch; nothing can therefore be said about the characteristic form of the colony. The present stem is 6 cm. high and about 1.5 mm. in diameter, slightly flattened, and with the conical verrucae occurring chiefly in a crowded zigzag row along the edge. They are more crowded near the slightly swollen tip.

In the outer layer the fairly thin coenenchyma contains elongate plate-like spindles with sculptured surface, yellow in color, which decrease in size in the red verrucae where they become simple spindles. The verrucae have a slightly stellate, oval orifice. The inner layer of the coenenchyma contains smaller, slightly warted spindles, bright red in color. The color of the colony is clear yellow; the operculum contains a few double rows of warted yellow spindles, and the collaret a few transverse rows of similar spindles. The axis is brown and fibrous.

The outer spindles may be as much as 0.75 mm. in length the spindles in the verrucae about 0.40 mm. and those in the inner layer about 0.30 mm. The rods in the operculum are about 0.35 mm. long; those in the collaret are slightly longer.

Type: — M.C.Z. cat. no. 4626.

Type locality: — North of Bahia, Brazil (lat. 11° 49′ S; long. 37° 15′ W) in 200 fms. ("Hassler" Exp.)

Specimens examined: — The type.

Remarks: — The coloration of the spicules in this genus appears to be reliable, and the striking colors of this species ought therefore to be sufficient to distinguish it from any other form.

4. Thesea rubra spec. nov.

Plate 7, fig. 4; plate 11, figs. 8–10

This form is represented by numerous specimens, the largest being 10 cm. high. It has a straight stem which gives off a few, long, upward turning branches; the lower branches in turn give off one or two long branchlets, all in one plane. The branches may be as much as 3 mm. in diameter and distinctly thickened at the tip. The verrucae are low, broad, wart-shaped. On the lower part of the branchlets they are laterally placed; in the upper part, more uniformly distributed. The orifice is stellate and the operculum is often expanded. The surface of the coenenchyma is finely granulose.

The color is in all cases red, due to the color of the spicules in the outer layer. The axis is brown and fibrous.

The spicules in the outer layer of the coenenchyma consist chiefly of red double heads with a variable number of larger, irregular, warted red grains occurring at intervals. In the inner layer are chiefly white spicules of varying form, a few thick short bodies, a few double cones, and a large number of more sparingly warted spindles. The operculum contains a few double rows of warted red spindles, and the collaret from 3 to 4 rows of similar, curved spindles.

The outer double heads are 0.15–0.20 mm. in length; the irregular grains as much as 0.55 mm.; the double cones and simple spindles average about 0.25 mm.; the collaret and opercular rods about 0.45 mm.

Type: — M.C.Z. cat. no. 4627.

Type locality: — Off Cariacou, in 163 fms. ("Blake" Sta. 241).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4627	241	163	Off Cariacou	numerous
4628	249	262	" Grenada	1
4629	253	92	" "	1
4630	263	159	" "	1
4631	271	458	" Bequia	2

Remarks: — The species is easily recognized by its color, its simple mode of branching, the unusually thickly packed layer of spicules, and the difference in color between the spicules of the outer and of the inner layer.

5. Thesea gracilis spec. nov.

Plate 12, figs. 4–8

Corallium slender, loosely branched, with rather long branches and branchlets which turn upward. The type is about 6 cm. high (top apparently broken) and 7 cm. wide, the unusual width being due to the wide expansion of the branches near the base. The branchlets are slender, about 0.8 to 1.2 mm. in diameter. The coenenchyma has an external layer, often incomplete, of relatively large, elongated, thick, oblong and fusiform spindles, mostly with blunt or unequal ends. They are snow-white, strongly sculptured transversally, and as a rule fit closely together. The inner layer consists of much smaller and more regular slender, acute, warted spindles, often bright red or colorless. The two layers are strongly contrasted. The verrucae are small, immersed or nearly so, usually only the margins showing between the larger spicules. They are rather irregularly scattered and placed some distance apart. Their diameter is from 0.3 to 0.5 mm. The operculum contains small red twin-spicules arranged in triangles; collaret apparently absent.

The axis is brown, pale yellow in the finer branchlets, soft, and with numerous transverse septa. The type was attached to a piece of rock, and has a small, irregularly folded and twisted basal disk.

The larger coenenchyma spicules are as much as 4.00 by 0.80 mm.; the smaller inner spicules average 0.35 by 0.05 mm.

Type: — M.C.Z. cat. no. 4160.

Type locality: — Off Dominica Island, in 118 fms. ("Blake" Sta. 177).

Specimens examined: — The type.

6. Thesea citrina spec. nov.

Plate 12, figs. 1–3

The type is about 12 cm. in height, slender, with several long slender branches and shorter branchlets, all of which show a tendency to grow upwards in candlestick fashion. The surface of the coenenchyma is relatively smooth and covered

by large, thick, very unequal, mostly elongated, embossed spicules; the larger ones are often one-third to nearly one-half of the diameter of the branchlets. Around the completely retracted zooids a number of smaller spicules of similar shape are arranged in circles.

The axis is brown; in the branchlets it is yellow and soft, with numerous transverse septa. The color of the colony is brownish yellow, due to the color of the outer layer of spicules. The base is club-shaped and is twisted around a piece of coral.

The outer layer of spicules in the coenenchyma are mostly large, oblong, and blunt. They are finely granulated on the surface and usually contain one longitudinal furrow and several transverse furrows which subdivide the surface indistinctly. A number are spindle-shaped with spiculose surface. All the spicules in this layer are bright yellow in color. The inner layer consists of an abundance of smaller spindles with girdles of spines, mostly colorless; some are bright red.

The spicules around the verrucae are yellow, mostly blunt, of the same type as in the coenenchyma, but smaller. The operculum contains usually one pair of large, strongly diverging, yellow twin-spicules meeting at the tip, and one or two pairs of smaller spindles. In the zooids which I have seen the collaret is reduced to a single row of spicules.

The large, outer, plate-like spindles may be as much as 2.60 by 0.27 mm.; the smaller spindles in the inner layer, about 0.35 by 0.05 mm.; the spicules in the tentacles and in the collaret are about 0.30 by 0.05 mm.

Type: — M.C.Z. cat. no. 4632.

Type locality: — Off Dry Tortugas, in 42 fms. (Pourtalès Gulf Stream Explor.).

Specimens examined: — The type.

7. Thesea rugosa spec. nov.

Plate 7, fig. 1

The three specimens in the collection are all large (as much as 15 cm. in height), and sparingly branched, with 1 to 4 upward bending, long branches of almost the same thickness as the stem (2–3 mm.). The verrucae are conical, fairly prominent, and scattered over the entire surface with some tendency toward a lateral arrangement. The surface of the coenenchyma is smooth, due to the closely fitting oblong deposits, and also undulated. The verrucae have stellate orifices; the operculum and collaret are contracted.

The color of the colony when dry is pale orange, due to the color of the spicules in the outer layer; the axis is brown, fibrous.

The outer layer of deposits consists of large, mostly oblong plates with somewhat convex surface and transverse ridges or low projections. In the verrucae the deposits become smaller and spindle-shaped; around the margin they are arranged in eight chevrons. The inner layer consists of smaller, mostly colorless, irregularly warted spindles, often with blunt ends; many are club-shaped. The operculum contains a few rows of curved spindles of varying thickness and with rough surfaces. In the collaret are a few transverse rows of slender bow-shaped spindles with a few spines on the outer side.

The external spicules may be as long as 1.65 mm.; those in the inner layer 0.45 mm. Most of them average about 0.20–0.25 mm. The opercular spindles and those in the collaret are about 0.45 mm. in length.

Type: — M.C.Z. Cat. no. 4633.

Type locality: — Off Dry Tortugas in 101 fms. ("Blake" Sta. 45), 2 specimens.

Specimens examined: — The material from the type locality, and a colony taken off Grenadines ("Blake" Sta. 241), in 165 fms. M.C.Z. Cat. no. 4634.

8. Thesea parviflora spec. nov.

Plate 7, fig. 2; Plate 11, figs. 22–23

The collection contains only one specimen of this species. The colony is about 14 cm. high with long branches which arise from the middle part of the stem and bend gracefully upwards, terminating at almost the same level. The branches are slender, 1.5 mm. in diameter; the stem, 2.5 mm. The coenenchyma is thin and firm. The verrucæ are small flat cones, not crowded, arranged along the edges of the branches and branchlets in alternating rows; only rarely present on the ventral or dorsal surfaces.

The color of the colony is white or slightly pinkish. The stem is brown and fibrous.

The coenenchyma contains an outer layer of rather thick, oblong deposits with rounded ends and an embossed surface. Between these are smaller deposits; and in the verrucae there are also small deposits which become spindle-like. In the margin they are arranged in chevrons. The zooids in the present specimen are in most cases expanded and contain a high operculum with a number of

double rows of small spindles and a distinct collaret. The inner layer contains the typical smaller, sparingly warted spindles.

The larger external spicules may be as large as 1.10 mm. by 0.50 mm.; those in the inner layer, 0.30 mm.; those in the operculum as long as 0.20 mm., and in the collaret, about 0.25 mm.

Type: — M.C.Z. cat. no. 4635.

Type locality: — Off Dominica Island, in 118 fms. ("Blake" Sta. 177).

Specimens examined: — The type.

9. Thesea guadalupensis Duchassaing & Michelotti

Plate 7, fig. 3; Plate 11, figs. 14–15

Thesea exserta Duchassaing & Michelotti, 1860, p. 18. — Kölliker, 1865, p. 137, pl. 17, fig. 18. — Nec *exserta* Ellis & Solander, 1786, p. 87.

Thesea guadalupensis (partim) Duchassaing & Michelotti, 1864, p. 12, pl. 2, figs. 3–4.

Non *T. guadalupensis* Riess, 1929, p. 402, pl. 8, fig. 5.

The collection contains a large fragment of the type and also a large complete colony which is 20 cm. high. It corresponds with the figures given by Duchassaing & Michelotti. The colony branches as usual in one plane with long, upward turning branches which arise from the middle third of the stem. The two lowermost of these branch again and carry similar long branchlets. The diameter of the branches is about 2 mm. The verrucae are conical, in most cases, uniformly distributed, and with stellate orifice. The operculum and collaret are expanded in several instances.

The color is dirty white in the dry condition; the axis is dull brown and fibrous.

The outer layer of the coenenchyma is covered by oblong colorless deposits, with irregular transverse ridges on the glistening outer side. The verrucae contain smaller deposits; around the orifice the spindles are arranged in chevrons. The spindles in the inner layer are slender, with scattered clusters of warts. The operculum contains a few pairs of simple, finely granulated spindles arranged in double rows, and the collaret contains similar slightly curved rods in 2–3 rows.

The larger deposits in the outer layer may be as much as 1.20 mm. in length; the smaller, 0.45 mm. The spindles in the inner layer vary from 0.25 to 0.45 mm. The opercular rods measure about 0.50 mm.; the collaret as much as 0.55 mm.

Type: — Fragments in Br. M. and M.C.Z.

Type locality: — Off Guadeloupe, in deep water.

Distribution: — Known from the type locality, and off Cariacou ("Blake" Sta. 241), in 163 fms.

Specimens examined: — A fragment of the type, received through Kölliker, and a large complete specimen from "Blake" Sta. 241, M.C.Z. cat. no. 4636–37.

Remarks: — The present fragment of the type agrees with Duchassaing & Michelotti's smaller figure (pl. 2, fig. 4) and with Kölliker's figures of the spicules (pl. 17, fig. 18.) A colony in Br. M. from Turin is labelled *T. guadalupensis* but represents a different species with large marginal thornscales. (See p. 131.)

10. Thesea grandiflora spec. nov.

Plate **33**, fig. 3

The collection contains two large colonies and some fragments (beside the variety). The largest colony, in which the top is broken, seems to have been at least 15 cm. high. It is a profusely branching form with a stem which gives off several branches in the same plane. These branches in turn carry short to long branchlets which diverge at wide angles, sometimes bent upward, sometimes not. Occasionally a fusion of branches may take place. The branches, which are almost as thick as the stem, usually become thicker toward the tip. In the large specimens the diameter is about 2–2.5 mm. The verrucae are low and conical, with a large stellate opening. The tentacles are completely retracted in the present specimens. The surface of the coenenchyma is rough and granulose due to the warted irregular grains which cover it. Here and there the grains are larger, more plate-like, with smooth undulated surface.

The color of the large specimens is pale brown; of the fragments, pale brown or white. The axis is olive brown and fibrous.

The outer layer of the coenenchyma contains irregular warted grains which sometimes become larger, resembling cobblestones. Sometimes a single large scale is present, or a few double cones. The inner layer contains pointed rods with the warts arranged in irregular bands. In the verrucae are spindles which are arranged in chevrons in the margin. The collaret and operculum have the usual armature.

The outer grains average about 0.30–0.40 mm. in length, the double cones about 0.30 mm., and the spindles in the inner layer, 0.20–0.30 mm. The rods in the collaret and opercular are between 0.30–0.50 mm. long.

Type: — M.C.Z. cat. no. 4638.

Type locality: — Off Tortugas, in 101 fms. ("Blake" Sta. 45).

Specimens examined. — Two specimens from the type locality, and some fragments collected off Grenada in 92 fms. ("Blake" Sta. 253), cat. no. 4639, and off Montserrat in 88 fms. ("Blake" Sta. 155), cat. no. 4640. From the latter locality were taken also two small colonies which possibly represent young stages, but at present they are described as a variety.

10a. Thesea grandiflora var. rugulosa var. nov.

Plate 11, figs. 4–7

The collection contains two small colonies, 5 cm. high, which were taken together with a fragment of the typical form. The stem and branches are slightly thinner (1.5 mm. wide), but otherwise the exterior, with the predominantly short branchlets and laterally placed verrucae, agrees well with the large typical form. The most striking character is the covering of the coenenchyma: in one specimen, exclusively flattened plates with undulated surface; in the other specimen, flattened plates intermingled with smaller grains. The spicules in the inner layer and in the verrucae, operculum, and collaret, resemble closely those found in the large specimens of *T. grandiflora*.

The largest scales or plates are 0.95 mm. in length; the double cones average about 0.25 mm.; the inner spindles, between 0.20 and 0.30 mm., as in the typical form. The opercular spicules and those in the collaret are of the same size, 0.40–0.50 mm.

Type: — M.C.Z. cat. no. 4641.

Type locality: — Off Montserrat, in 88 fms. ("Blake" Sta. 155).

Specimens examined: — Two specimens.

11. Thesea hebes spec. nov.

Plate 11, figs. 19–21

The collection contains several colonies varying in height from 6 to 20 cm. The stem and branches are of about equal thickness in all specimens (3 mm.). The branches are long and bent upward, resembling a candlestick. The verrucae are low, conical, and fairly uniformly distributed over the surface, with some tendency toward crowding along the sides. The verrucinal opening is distinctly stellate. In many cases the operculum is retracted, filling the verrucinal orifice or forcing it to expand completely. The surface of the colony is irregularly rough as the individual grains are not closely fitted together.

The color is white or dirty gray; the axis is brown and fibrous.

The outer layer of the coenenchyma contains thick, regularly warted grains of extremely variable size. There are in addition a few double cones which are smaller than the average size of the roundish grains. The verrucae contain warted pointed spindles arranged in chevrons around the verrucinal edge. In the inner layer are small, slender spindles with scattered warts. The operculum contains a few double rows of curved spindles slightly warted; the collaret, 2–3 transverse rows of similar curved spindles.

The outer deposits are 0.20–0.40 mm. in length; the double cones, 0.25 mm.; the spindles in the inner layer, about 0.20 mm. The spindles in the collaret may be as long as 0.30 mm., and the opercular spindles are of about the same size.

Type: — M.C.Z. cat. no. 4642.

Type locality: — Off St. Vincent in 88 fms. ("Blake" Sta. 232).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4643	157	120	Off Montserrat	1
4644	166	150	" Guadeloupe	5
4642	232	88	" St. Vincent	5

12. Thesea nivea spec. nov.

Plate 7, fig. 7; Plate 11, figs. 16–18

The collection contains only the fragments of one or two specimens. They seem to indicate that the species reaches a height of at least 25 cm. It is sparingly branched with long branches, bent upward. The verrucae are low, broad, conical in shape, and are not crowded over the surface. The marginal opening is distinctly stellate; in most cases the tentacles are completely withdrawn. The operculum is expanded in a few of the zooids. The coenenchyma is thick and of exceptional firmness, finely granulated when seen under the lens.

The color of the colony is pure white; the axis is brown and fibrous.

The outer layer of the coenenchyma contains a large number of double heads and double cones, the latter being about twice as long as the double heads. The inner layer contains, as usual, simple spindles with fairly scattered warts. In the operculum are a number of curved spindles slightly warted, and the collaret contains similar arched rods in 2–3 rows.

The double heads average about 0.15–0.20 mm. across; the double cones,

about 0.35 mm. In the inner layer the spindles may be as much as 0.35 mm. long; collaret spindles, 0.70 mm., and the opercular spindles, about 0.50 mm.

Type: — M.C.Z. cat. no. 4645.

Type locality: — Off Guadeloupe in 196 fms. ("Blake" Sta. 159).

Specimens examined: — The type.

Remarks: — This species bears some resemblance to *T. hebes*, but in the latter form the outer deposits are of exceedingly variable form, and the texture is much less firm and hard.

13. Thesea plana spec. nov.

The collection contains fragments of three colonies which, in the manuscript, are described as a new species and genus, but which I think belong to *Thesea*.

The colonies must have been 15–20 cm. high with a stem a few mm. wide and with numerous crooked branches, not in one plane, bearing shorter branchlets. The tips are not intact and it is therefore impossible to say anything definite about the length of the branches. The zooids are low, conical, and scattered irregularly over the surface. The operculum is retracted, and the orifice is closed by spindles arranged in chevrons and forming a regular star.

The coenenchyma is whitish, firm, with a velvety surface, the axis is pale brown, wood-like, and fibrous.

The spicules in the coenenchyma consist of an outer layer of small double heads and an inner layer of straight or curved spindles. Both kinds of deposits are covered by coarse composite warts. In the zooids the spindles are smaller and arranged in bundles around the margin of the verrucae. The operculum contains a few pairs of warted spindles, and the collaret a few rows of similar curved rods. The double heads average about 0.15 mm. across; the spindles are from 0.30 to 0.70 mm. in length, the spindles in the operculum and collaret being about 0.20 mm. long.

Type: — M.C.Z. cat. no. 4646.

Type locality: — West of Tortugas, in 42 fms. (Pourtalès Gulf Stream Explor.).

Remarks: — In spite of the irregular curved and bent branches this form seems to belong in *Thesea*. The spicules resemble somewhat those found in *T. nivea*, but the composite warts are much coarser, and the spindles are never developed as double cones in the present form as they are in *T. nivea*.

Thesea? sp.

Plate **12**, figs. 13–15

The collection contains two colonies which in the manuscript are referred to *Stenogorgia*. In their outer shape they have a certain similarity to that genus. They are about 8 cm. high with a stem 2 mm. wide which, at some distance from the base, gives off long widely diverging branches. The colonies are in dry condition somewhat apt to curl. The zooids form scattered low verrucae. At the tip of the branches they usually occur 2–3 together, as in most species of *Stenogorgia*. Some of the anthocodia are expanded. There is an operculum with a few pairs of warted curved rods, and a collaret with a few circles of similar spindles. The spicules in the coenenchyma consist of simple spindles with clusters of composite warts; with low magnification these spindles appear transversally furrowed. Toward the edge of the verrucae the spicules become smaller and are arranged in eight points. Outside the firm layer of spindles there is a thin layer of small, delicate, bi-horned deposits with flattened base, narrowly constricted near the base. They are easily overlooked; in some places they have been rubbed off. The colony is white; the axis pale brown, and fibrous.

The spindles average 0.50–0.60 mm. in length; the opercular spindles and those in the collaret are about 0.40–0.50 mm. long; the bi-horned outer deposits, 0.20–0.30 mm. Usually the horns are broken off.

Specimens examined: — The type, and another specimen, both without locality. M.C.Z. cat. no. 4647.

Remarks:— This form seems to have a unique position, and it may belong in a separate genus. It is very likely to be confused with other forms on account of the delicacy of the outer layer of deposits which are easily overlooked. It seems to be near to *Thesea*, but for the present I leave its position undecided.

Genus. 7. Bebryce Philippi 1842

Diagnosis, partly from Kükenthal, 1919, p. 841: — Colonies branching in one plane with widely diverging branches. Zooids laterally placed, irregularly alternate, and well separated. Verrucae usually slender with a narrowed base, or low and cylindrical in shape. Tentacles retractile; opercular spicules in chevrons, and collaret developed.

Outer layer of spicules in the form of cups, the margin frilled with finger-like projections; inner layer of spicules as crosses or stars, with central low projec-

tions, and a variable number of warts or spines. A few spinous rods may be present in the verrucae, sometimes with one end pointed and one plate-like.

Type species: — *Bebryce mollis* Philippi.

Remarks: — Kükenthal (1924, p. 208) lists only one species; Thomson, 1927, gives one additional species. A number of forms which previously were included in this genus are transferred to *Pseudobebryce* (Kükenthal, 1919, pp. 759, 841); they are all Pacific forms.

Three species of *Bebryce* occur in the West Indies, one of which seems to be identical with the "*B. mollis*," which is listed in Kükenthal's paper as occurring in the West Indies, on the authority of Miss Riess (1929, p. 413).

Key to the species of Bebryce from the West Indian waters

1. Stout form, 2–3 cm. thick, with verrucae 2 mm. broad. Among spicules large four-armed crosses ..... 1. *B. grandis* spec. nov.
1. Slender form, about 1 mm. in diameter ..... 2.
2. Large, four-armed crosses dominating ..... 3. *B. parastellata* spec. nov.
2. Smaller six-armed stars or plates dominating ..... 2. *B. cinerea* spec. nov.

1. Bebryce grandis spec. nov.

Plate 8, fig. 3; Plate 10, figs. 9–21

The type is about 20 cm. high and 5 cm. broad. It is an exceptionally stout form with few, long, upward-curved branches and stout conical verrucae, mostly placed alternatingly along the sides; occasionally one is present on the front. The stem is about 3 mm. wide; the branches about 2 mm. wide, exclusive of the verrucae. The latter are about 2 mm. broad and 1.5 mm. high, and are separated by a distance of about 2–3 mm.

The axis is pale brown, wood-like, and very fibrous. The color in alcohol is faded brown to pinkish.

The spicules are as usual divided into an outer and an inner layer. The outer, cup-shaped bodies are usually regular, and similar in shape to those found in *B. cinerea*. The inner layer consists of stout, thick crosses or stars with heavy warts or spines. There are also some spinous rods, sometimes with one end flattened and disc-shaped.

The operculum contains a few pairs of curved spindles, and similar but more slender rods are present in the collaret.

The outer, cup-shaped bodies are about 0.09 mm. in height. The crosses

and stars measure about 0.25 by 0.25 mm.; the tentacle spicules about 0.16 by 0.04 mm., and the collaret spicules 0.24 by 0.03 mm.

Type: — M.C.Z. cat. no. 4607.

Type locality: — Off Montserrat, 88 in fms. ("Blake" Sta. 155).

Specimens examined: — The type and also a single young specimen, 30 mm. high and 2 mm. wide, from 154 fms. off Barbados ("Blake" Sta. 282), M.C.Z. cat. no. 4608.

Remarks: — This species seems to be very distinct. Even the young colony looks entirely different from the other species of Bebryce.

2. Bebryce cinerea spec. nov.

Plate 8, fig. 5; Plate 10, figs. 1–8

Bebryce mollis (*partim*) Kükenthal, 1924, p. 208. — Riess, 1929, p. 413, text fig. 4.
Non *B. mollis* Aurivillius, 1931, p. 190, text fig. 37.

Several specimens are in the collection. The largest measure about 100 mm. in height, and from 40 to 80 mm. in breadth. It is a loosely branched form with shorter or longer terminal branchlets, often slightly curved, and a row of low verrucae on each side of the branch; rarely one or two are placed on the front side. The verrucae are about 1 mm. wide, and usually separated from one another by the same distance except near the ends where they are closer together. The branches and branchlets are about 1–2 mm. in width, exclusive of the verrucae; in some of the oldest specimens the stem attains a diameter of about 4 mm.

The axis is pale brown and decidedly wood-like in structure. The color of the specimens, faded in alcohol, is dirty grey.

The entire surface of the colony is covered with a dense layer of cups typical of the genus; beneath these there is a layer of large, stellate plates with radiating foliations and numerous protuberances, mostly also a central "handle." A few spinous rods are present, sometimes spindle-formed, sometimes with a more flattened basal portion. The tentacles, which are usually contracted, contain a few pairs of spinous curved spicules; in the collaret are a few rows of slender bow-shaped spindles. The margin of the verrucae is without any special armature.

The external cups are about 0.08 mm. in height and half as much in breadth; the stellate plates, about 0.15–0.22 mm. in diameter; the opercular spicules about 0.30 by 0.05, and the spicules in the collaret about 0.50 by 0.02 mm.

Type: — M.C.Z. cat. no. 4611.

Type locality: — Off Barbados, in 94 fms. ("Blake" Sta. 276).

Specimens examined: — The type and also specimens from stations 273, 277, and 293 in the same vicinity, in 76, 82, and 106 fms. respectively; and off St. Vincent, in 95 fms. ("Blake" Sta. 231); M.C.Z. cat. nos. 4612–15.

Remarks: — This species seems to be very closely related to the type species, *B. mollis* Philippi, which is known from several localities in the Mediterranean, and off the Azores. Kükenthal (1919) lists it from 55 m. off Barbados. His figure of *B. mollis* from Seinebank (1919, p. 294) is somewhat more slender than the West Indian form. Unfortunately, he gives no figures of the latter, and those given by Koch of the Mediterranean form do not appear to be sufficiently exact. Koch figures (1887, pl. 1, fig. 1) a relatively simple star-shaped spicule, but leaves out all the typical, thin, plate-like forms, perhaps because it was impossible to reproduce them with the optical instruments of his day.

Kükenthal (1924) and Riess (1929) give short descriptions of the species, but do not figure the spicules. The measurements of the spicules seem to indicate that there is some difference in the eastern and western forms (0.96 mm., length of collaret spindles in *B. mollis;* 0.5 mm. in the "Blake" specimen). Actual comparison does not seem to have been made, and I have therefore kept the two forms separate.

Aurivillius's *B. mollis* from Josephine Bank seems nearer to *B. stellata* Thomson.

3. Bebryce parastellata spec. nov.

Plate 8, fig. 4; Plate 10, figs. 22–28

This species is represented by five young unbranched specimens, about 60 mm. high, and two, poorly preserved branched specimens with few, widely diverging branches. Diameter of stem and branches about 1 mm. The cylindrical verrucae, in the unbranched specimens, are about 1 mm. high and equally wide and placed almost in one plane, on the sides of the branches and separated by approximately their own diameter; in the branched specimens they are somewhat more widespread and more contracted.

The spicules form a similar outer and inner layer as in the two other species. The cup-shaped deposits are somewhat larger, and the outer part radiates more in a fan-like fashion. The stars and crosses of the inner layer are very similar to those found in *B. grandis;* they are thick and robust, with strongly developed warts or spines.

The cups are about 0.1 mm. high and equally wide; the larger crosses in the inner layer measure about 0.25 by 0.25 mm.

Type: — M.C.Z. cat. no. 4609.

Type locality: — Off Barbados, in 100 fms ("Hassler" Exped.).

Distribution: — Known from the type locality and off Cuba.

Depth: — From 22 to 100 fms.

Specimens examined: — Five unbranched and two branched colonies from the type locality; one branched colony from off Cuba.

Remarks: — This species resembles superficially *B. cinerea*, while its spicules are almost identical with those characteristic of *B. grandis*. The description which Thomson gives of his *B. stellata*, from the Mediterranean Sea, suggests very much this species and it is only for the sake of consistency that a new name has been given, in order to conform with the treatment of *B. mollis* and *B. cinerea*.

It is possible that in spite of the apparent great discrepancies between the spicules, larger series will show that *B. cinerea* intergrades with *B. parastellata* or that the latter represents the juvenile stage, just as *B. stellata* possibly will be found to represent the youthful form or a variety of *B. mollis*.

Genus 8. Eubrandella nom. nov.

Lissogorgia Verrill, 1864b, p. 22.

Fan-shaped Mureeeids with numerous anastomoses, forming oblong meshes. Zooids scattered all over the branches, low, and with an operculum able to contract to the bottom of the verrucae. Spicules as warted spindles and numerous star-shaped plates which become thorn scales in the verrucae, with one short, broad, smooth, projecting spine. Operculum with one pair of rods, occasionally with one three-armed rod; a few rows in the collaret. Shallow water forms.

Type: — *Eubrandella flabellum* (Verrill).

I have been unable to refer this form to any genus recognized in Kükenthal's paper (1924). It shows great similarity to some of Nutting's (1910b, pp. 92–93) species of *Heterogorgia:* it has the same way of branching, the same low verrucae with the operculum placed almost at the bottom of the verruca in the dry specimens, but none of the star-shaped spicules seem to have developed as thorn scales with one smooth projecting thorn. It also seems to have some affinity to *Brandella* (Nutting's *Villogorgia*, 1910, p. 69.).

The species was first described in 1864 as *Lissogorgia flabellum* (new genus, established for the present specimen, which was then supposed to be identical with *Gorgonia cancellata* Dana, 1846, p. 658, a synonym of Esper's *Antipathes*

flabellum and *Gorgonia pseudo-antipathes*, first described by Pallas, according to Esper 1797, II. p. 32). Pallas' and Esper's species were collected from the East Indies; the type seems to have been lost. The description and the figures are of so general a character that it is impossible to base any determination upon them. Dana's *Gorgonia cancellata* had no locality; it is merely stated that it is identical with Esper's two species, and these names were both preoccupied. It therefore seems rather certain that the East Indian species is not identical with the present. Later (1866, p. 413), Verrill changed the name *Lissogorgia flabellum* to *L. cancellata* (Dana) as he found that the first name had been preoccupied twice, and at the same time he dropped *Lissorgorgia* and adopted Kölliker's term *Echinogorgia*, which was a few months older and seemed to him to agree completely with his definition of *Lissogorgia*.

In 1868a, p. 413 he placed the species in *Paramuricea*, and added a number of taxonomic remarks. Among other things he thought that it was identical with what Kölliker had named *P. nigrescens* (Duchassaing & Michelotti) which in his manuscript he placed in a new genus, with a new name; Köllikers species seems to be different from Duchassaing & Michelotti's species, which he thought was a *Bebryce*.

Kükenthal (1919) lists Dana's species *cancellata* as a *Paramuricea*, but places it among the dubious species and gives as locality the Indian Ocean, affixing a question mark. He does not mention that, according to the literature, the species was also supposed to occur in the West Indies.

The name *Lissogorgia* must evidently be dropped, and also the name *cancellata*. In the present paper the name *Eubrandella* has been used, but it may be that the genus will be found to be one already known.

Eubrandella flabellum (Verrill)

Plate **13**, figs. 1–15

Lissogorgia flabellum Verrill, 1864b, p. 22.
Echinogorgia flabellum Verrill, 1866a, p. 283.
Paramuricea cancellata Verrill, 1868a, p. 413.

The unique specimen represents a colony about 20 cm. high and 20 cm. broad, distinctly flabellate, with short stem and numerous strong branches which are connected by short transversal anastomoses so that they form oblong meshes. The zooids are uniformly scattered over the branches. The verrucae are low, rounded warts, and the operculum is completely lowered into the verrucae. The branchlets have flattened, wing-like bases.

The spicules in the coenenchyma consist of spindles with warted surfaces. The closely-set verrucae contain rows of star-shaped thorn scales; the projecting spine is smooth and the remaining part or the scale is rough. In the operculum there are either two simple rods, side by side, or one three-armed rods with smooth projection and rough basal arms. The collaret contains about three rows of curved rods.

The color of the dry specimen is pure white; the axis is horny, dark brown in the stem and pale yellow in the terminal branchlets.

The coenenchyma spindles may be as long as 0.40 mm. The thorn scales measure about 0.30 mm. lengthwise and crosswise. The opercular rods are about 0.20 mm. long and 0.15 mm. high; the spicules in the collaret 0.30 mm. long.

Type: — M.C.Z. cat. no. 4651.

Type locality: — Off Florida, no depth given (Williams College Exp.).

Specimens examined: — The type.

Remarks: — The species is easily recognized on account of its numerous anastomoses, its regular flabellated form, and the characteristic spicules. I have been unable to identify it with any other form. It is remarkable that it has never been found in Florida again.

Genus 9. Acanthacis gen. nov.

Thesea (partim) Duchassaing & Michelotti, 1860.

Diagnosis: — Muriceids branching in one plane, irregularly, dichotomously. Verrucae low, barely raised above the surface, laterally placed, and armed with eight marginal projecting thorn-scales with long spine. Spicules in the coenenchyma as a single layer of heavy plates or spindles. Operculum with one pair of large spindles and several smaller spindles intercalated in each section; collaret with two-three rows of spindles.

Type species: — *Acanthacis scabra* spec. nov.

Two species are described in the following pages, both from the West Indies. Verrill mentions in his manuscript that *Acis spinosa* and *A. ulex* Thomson & Henderson (1906, pp. 77, 237, Plate 1, figs. 2–5, Plate 9, fig. 6;) most likely belong to this genus; Kükenthal (1919) places these two forms in the genus *Paracis*.

Key to the species known from the West Indian waters

Spicules in coenenchyma chiefly as spindles ..... 1. *A. scabra* spec. nov.
Spicules in coenenchyma chiefly as irregular plates or scales ..... 2. *A. austera* spec. nov.

Acanthacis scabra spec. nov.

Plate 8, fig. 1; Plate 13, figs. 21–25; Plate 29, figs. 1, 1a-b

There are three specimens in the collection ranging from 7 to 20 cm. in height. The colonies are slender, the branches diverge at various angles, irregularly and dichotomously. The verrucae are extremely low and placed laterally, often two individuals close together, and these pairs are separated from the following verrucae by about the same distance as one pair occupies. The marginal thorn scales project as slender, vertically placed spines, often broken.

The color of the colony is white; the axis is pale grey, wood-like.

The coenenchyma spicules consist of mostly blunt spindles regularly warted with branched warts. They are mostly arranged lengthwise. Similar spicules occur in the low verrucae. The marginal spicules form typical thorn scales. They have a remarkably long, cylindrical, almost smooth spindle and a small, warted basal part, often bifurcated. The operculum consists of two large rods in each division, and one-two smaller rods intercalated; the collaret of two-three transversal rows of spindles. The coenenchyma spicules vary greatly in size. They were found to be largest in the small specimens, and in the terminal branchlets of the large specimens.

The marginal thorn scales may be as large as 0.60 mm; the coenenchyma spindles, about 0.8 mm.

Type: — M.C.Z. 4648.

Type locality: — Off Montserrat, in 88 fms. ("Blake" Sta. 156).

Distribution: — Known from the type locality and off Guadeloupe.

Specimens examined: — Three colonies from the type locality and one from Guadeloupe in Br. M.

Remarks: — The colony in Br. M. came from Turin, and is labelled *Thesea guadalupensis* Duchassaing & Michelotti. Although the label undoubtedly is correct, the colony cannot be regarded as the type of that species since it is evident from Duchassaing & Michelotti's description, and at least their smaller figure, and from Kölliker's description and figure, (1865, p. 137, Plate 17, fig. 18) that what they considered *T. guadalupensis* had only spindle-shaped spicules, in agreement with a fragment, sent from Duchassaing & Michelotti's collection to Verrill, through Kölliker (obviously the one from which Kölliker's figure was made).

Acanthacis austera spec. nov.

Plate 8, fig. 2; Plate 13, figs. 16–20

The collection contains nine colonies, eight of which are from one locality. They vary in size from 5 cm. to 25 cm. in height. The species is a stout form with slightly flattened stem and branches, branching in one plane, with widely diverging branches and branchlets. In a medium sized specimen the stem is about 4 mm. wide, the branches and branchlets 2–3 mm. In the largest specimen the width of the stem increases to about 8 mm., while that of the branches and branchlets remains about the same. The verrucae are placed on the edges, somewhat closer to one side. They are barely raised above the surface and carry eight strong, vertically projecting spines, which reach beyond the low operculum.

The color of the colony is white or grey; the axis is pale grey, wood-like.

The spicules in the coenenchyma consist of one layer of irregular plates or scales, which form a cobblestone-like pavement. They vary quite irregularly in size in various parts of the stem. Around the verrucae they are smaller and may bear a short conical projection. The marginal spicules have a strong, thick, almost smooth spine and a bi-lobed thick warted base. The operculum contains two large spindles in each section, and in the collaret are a few rows of curved spindles.

The largest plates measure about 1 mm. in length. The marginal spicules are 0.8, and the collaret spicules 0.5 mm. in length.

Type: — M.C.Z. no. 4649.

Type locality: — Off Grenada, in 262 fms. ("Blake" Sta. 249).

Specimens examined: — Eight from the type locality, and one from 163 fms. off Grenada ("Blake" Sta. 241); M.C.Z. cat. no. 4650.

Genus 10. Trachymuricea gen. nov.

Diagnosis: — Muriceids with large, conical verrucae and high, apparently non-retractile operculum, with numerous rows of spindles arranged in convergent rows, and placed on a high collaret in which are numerous rows of transversally placed spindles. Spicules in the coenenchyma and in the verrucae occur as spinous rods with a rough projecting spine, which is centrally placed and erect in the coenenchyma spicules, and more terminal and slanting in the spicules of the verrucae.

Type species: — *Trachymuricea hirta* (Pourtalès).

Two species are the only forms known at present to be referred to this genus, and they are both from the Atlantic Ocean. The type species was briefly described by Pourtalès, without any figures, as *Acanthogorgia*. Verrill, who redescribed the species in his manuscript and established a new genus for it, evidently overlooked Broch's (1913, p. 26) excellent description of *T. kükenthali* from the coast of Norway, temporarily placed in *Paramuricea*. The two species seem to be closely related. The spicules of the Norwegian form are somewhat larger, but too few specimens are known at present to determine whether this difference is an absolute character. It may be that the Norwegian species will be regarded as a variety of the West Indian form.

Trachymuricea hirta (Pourtalès)

Plate **13**, figs. 26–33

Acanthogorgia hirta Pourtales, 1867, p. 131.
Paramuricea hirta Verrill, 1883, p. 35. — Kükenthal, 1924, p. 241.

The four colonies in the collection are all small, the largest one measuring about 10 cm. in length. It is a slender, flexible form with long, soft branches arising alternatingly from the flexible stem, at intervals of about 1 cm. The verrucae are large and sparingly distributed, mostly along the sides, and slightly nearer to the "ventral" side. They are crowded near the tips. The operculum, which contains numerous rows of convergent spicules, is evidently non-retractile, and is placed upon a high collaret with numerous rows of transversally arranged spicules.

The color in alcohol is pure white; the axis is brown, horny, and very flexible.

The texture of the surface of the coenenchyma and of the verrucae is a rough chagrin due to the presence of numerous projecting rough spines of practically the same size. These arise from spinous rods and are placed erect and centrally in the coenenchyma spicules, and are slanting and terminal in those of the verrucæ. The rods in the collaret and operculum are pointed, sparingly spinous rods, often most smooth on the inner side.

The spicules may be as long as 0.50 mm. in the verrucae, and about 0.35 mm. in the coenenchyma. The opercular and collaret spicules may be 0.50 mm. long.

Type: — M.C.Z., cat. no. 4678.

Type locality: — Off Bahia Honda, Florida, at 324 fms. (Pourtalès Gulf Stream Explorations); 4 specimens. Also listed in Verrill's manuscript from off Barbados at 130 and 96 fms. ("Blake" Sta. 166 and 176).

Remarks: — The species seems to be closely related to *Trachymuricea kükenthali* (Broch), from off the coasts of Norway. The spicules are apparently somewhat more spinous and slightly smaller in the West Indian form.

Aurivillius, 1931, p. 175, text fig. 34, places *T. kükenthali* in the genus *Muriccides*. He has only examined two species of that somewhat dubious genus.

Genus 11. Paramuricea Kölliker, 1865

Diagnosis (modified) from Broch, 1912a, p. 20: — Holaxonia with purely horny fibrous axis, branching chiefly in one plane. Zooids distributed freely over the branches, with distinct verrucae wherein the upper part can be withdrawn. Operculum with spicules in converging rows, at least two pairs in each section. Spicules in the coenenchyma as rods or crosses, often star-shaped; sometimes plate-like; in some species with projecting central spine. In the zooid-walls, scales in eight indistinct longitudinal rows, with mostly rough projection and varying development of the basal part. Opercular spicules and those in the collaret as spinous rods.

Type species: — *Paramuricea placomus* (Linnaeus).

Remarks: — Kükenthal (1924, pp. 221–227) lists a number of species, some of which are undoubtedly synonyms of *P. placomus;* others are quite distinct, but possibly identical with some of those described in the following pages.

Aurivillius 1931, p. 156, has recently discussed the species from the Mediterranean and Atlantic Ocean.

Key to the species of Paramuricea known from the western Atlantic

1. Zooids scattered; large and conical. Coenenchyma and lateral walls of zooids strongly spinous, due to long projections arising from plate-like deposits ..... 1. *Paramuricea echinata* spec. nov.
1. Zooids crowded low, with more less retractile conical operculum. Coenenchyma and walls of zooids smooth or slightly spinous ..... 2.
2. Coenenchyma with spinous crosses or knee-bent spinous rods; plates rare or absent. Thorn scales with pointed projection ..... 2. *P. placomus* (Linnaeus).
2. Coenenchyma with plates with or without an outer projection ..... 3.
3. Some of the coenenchyma plates with strong outer projection ..3. *P. multispina* spec. nov.
3. None of the coenenchyma plates with strong outer projection .....4. *P. grandis* spec. nov.

The first of these species is very distinct, the remaining may possibly be different forms of *P. placomus* (L.), but judging by the present material they show distinct differences in their spiculation. It has therefore seemed preferable to describe them separately. They may be identical with some of the species described from deeper water off the Azores by Studer (1901) and Thompson (1927).

1. Paramuricea echinata spec. nov.

Plate **14**, figs. 22–28

The colony has a distinct stem which gives off at considerable intervals long lateral branches; these in turn bear a number of short branchlets. The branching is in one plane. The verrucae are few and widely distributed along the edges, rarely touching each other except near the tips. The verrucae are large and conical with long projecting spines; the operculum is low, rounded, often concealed. The surface of the coenenchyma is in places almost smooth, in other places strongly spinous with strong, vertically projecting spines.

The color of the colony when dry is dirty brown; the axis is pale, wood-like.

The spicules in the coenenchyma are thin plates with lobed margin, and often bear an enormous, thick, blunt projecting spine. In the verrucae the spine is eccentric in position. The operculum contains two long spinous rods in each section, and in the collaret there are usually three transverse rows of spindles.

Type: — M.C.Z. cat. no. 4691.

Type locality: — Off St. Croix in 580 fms. ("Blake" Sta. 131).

Specimens examined: — Three specimens from the type locality, and one from 580 fms. off Sta. Croix, "Blake" Sta. 124.

Remarks: — This species is well marked and cannot be confused with any others known at present from the West Indies. It may be identical with one of the east Atlantic species.

2. Paramuricea placomus (Linnaeus)

Plate **14**, figs. 1–13.

Paramuricea placomus Kükenthal, 1924, p. 221 (complete list of references).
P. borealis Verrill, 1882a, p. 364; 1883, p. 35, pl. 3, figs. 4, 5–5a.

The M.C.Z. collection contains one colony from Norway which agrees in all essentials with Broch's excellent description (1912, pp. 21–26), and with a small fragment from the "Blake" expedition, locality not given.

The colony forms a distinct stem, and has numerous branches and shorter branchlets, about 2–3 mm. in diameter, more or less situated in the same plane. Anastomosing is frequent. The zooids are numerous, most crowded near the ends of the branchlets, and form low smooth cones with a pointed operculum. They measure about 2 mm. in height.

The spicules in the coenenchyma consist of a crowded layer of branched rods, spinous crosses, and knee-shaped spinous rods; plates are rare. The walls of the zooids contain large thorn scales with a strongly pointed projection, more or less rough on the surface, and a small lobate basal part. The collaret contains three-four rows of curved spinous rods, and the operculum two-three pairs of similar spindles.

The coenenchyma spicules average 0.25–0.35 mm. in length. The thorn scales are about 0.70 mm. long, and the spicules in the collaret and operculum are of about the same length.

Type: — Most likely not preserved.

Type locality: — Off the coast of Norway.

Distribution: — According to Broch, known from deeper water off the coast of Europe and the east coast of North America, and also from the Mediterranean Sea (described by v. Koch).

Specimens examined: — A large branch from Norway (M.C.Z. cat. no. 4695), and a fragment without locality, probably collected off the coast of New England (cat. no. 4690).

Remarks: — Verrill's type of *Paramuricea borealis* taken off the coast of New England is lost, but it appears from his figures (1883, Plate 3, figs. 4, 5-5a) that *P. borealis* is identical with the Norwegian form. In his manuscript he insists upon the validity of *P. borealis*, but gives no explanation of the characters wherein it differs from *P. placomus*. He evidently overlooked Broch's paper of 1912.

Thomson (1927, p. 40) lists *P. borealis* (as *Echinomuricea*), collected off the Azores in 599 fms. and also describes *P. placomus*, but his *P. placomus* may be some other species. Verrill maintains that the Mediterranean *P. placomus*, described by v. Koch (1887, p. 49), has a long series of spicules in the operculum while the genuine *P. placomus* has two-three pairs.

The two West Indian forms, *P. hirta* and *tenuis*, which Jungersen referred to *P. placomus* without examination, belong to two other genera (see p. 133 and p. 143).

3. Paramuricea multispina spec. nov.

Plate **14**, figs. 29–43.

The collection contains two branches of this form, the largest one designated as the type, measuring about 15 cm. in length. In its outer shape, mode of branching, and size and distribution of the verrucae it very much resembles *P. placomus* (Linnaeus). It differs by having numerous, strong, stout spines projecting from the coenenchyma and also strong spines projecting from the sides of the verrucae.

The color is dirty grey and the axis wood-like.

The thorn scales have a stout projecting spine, and a more branched base than in *P. placomus*. The opercular rods are of the same slender type as in the latter species, and the coenenchyma contains the same kind of spinous rods, crosses and half crosses, and much indented plates, but there is in addition a variable number of large plates with a strong, blunt, projecting spine, centrally placed, which I never have seen in *P. placomus*.

The thorn scales are as much as 0.55 mm. in length; the opercular rods 0.70 mm.; the smaller crosses and rods in the coenenchyma between 0.10 and 0.40 mm. The large spine-carrying plates may measure as much as 0.70 by 0.40 mm.

Type: — M.C.Z. cat. no. 4693.

Type locality: — Off Grenada, in 262 fms. ("Blake" Sta. 249).

Distribution: — At present known from two localities in the West Indies.

Specimens examined: — The type, and a branch from "Blake" Sta. 296, Barbados at 85 fms. (with a question mark on the label).

Remarks: — The species is extremely well characterized by its stout conical projecting spines on the deposits in the coenenchyma and on the margin of those in the zooids.

4. Paramuricea grandis Verrill

Plate **14**, figs. 14–21

Paramuricea grandis Verrill, 1883, p. 37, pl. 3, figs. 3a–b. — Kükenthal, 1924, p. 224.
Lepidomuricea grandis Verrill, 1922, p. 16, pl. 8, figs. 1–2; pl. 10.

The type, and some branches overgrown with *Epizoanthus sp.* are in the collection, labeled *P. borealis* V. by mistake. It is a tall, stout form which grows to more than 50 cm. in height, with a well-developed stem and several branches and branchlets, mostly dichotomously divided, more or less in one plane, and with occasional anastomoses. The zooids form low smooth verrucae with a

conical operculum, which sometimes is almost withdrawn. They are numerous over the entire surface, being especially crowded toward the tips of the branchlets. The color is greyish; the stem is pale brown, fibrous and wood-like.

The spicules in the coenenchyma consist of large smooth plates with deeply incised and laciniated margin. There seem to be no crosses nor knee-bent rods as in *P. placomus*. The thorn scales have a thick, blunt-ending projection with rough surface and sometimes small lateral lobes; the basal plate is usually deeply cleft and laciniated. The collaret and operculum contain three-four transverse rows and two-three pairs of spindles, respectively, very much as in *P. placomus*.

The plates in the coenenchyma are about 0.20 mm. in length; the thorn scales may be as long as 0.20 mm., and the collaret and opercular rods 0.18 mm. in length.

Type: — M.C.Z. cat. no. 4949.

Type locality: — Of Georges Bank, in 524 fms. ("Blake" Sta. 306).

Distribution: — With certainty known from deep water off the coast of New England, but it may also occur in the eastern Atlantic, and be insufficiently described under some other name.

Depth: — Seems always to come from several hundred fathoms depth.

Specimens examined: — The type, and a branch from "Blake" Sta. 329, off Cape May at 630 fms.

Remarks: — It is possible that comparison with a large series of specimens will show that this species actually represents an extreme form of *P. placomus*, but as far as the present material is concerned, it is easily distinguished from *P. placomus* on account of its large scale-like deposits and blunt thorn-scales.

Genus 12. Muriceides Wright & Studer 1887

Diagnosis, from Kükenthal, 1924, p. 162: — Colonies branching in one plane, sometimes sparingly branched, sometimes unbranched. Zooids on all sides, occasionally laterally placed, mostly widely separated. Operculum with converging double rows of spicules. Verrucae generally higher than broad. Spicules with branched warts, eventually developing into thorn plates. In the verrucae the spicules are arranged longitudinally and may reach above the margin.

Type species: — *Muriceides fragilis* Wr. & Studer.

Remarks: — The genus is not known from the West Indian waters, but it is very likely that it occurs there. According to Kükenthal (1924, p. 162), and Thomson (1927, p. 43), there are five species in the eastern part of the Atlantic.

Note: — Thomson lists, 1927, the following forms: —

Muriceides furcata Studer, p. 43, pl. 4, fig. 4, pl. 5, fig. 14.

M. echinata spec. nov., pl. 44, pl. 5, fig. 25.

M. tenuis spec. nov., p. 44, pl. 4, fig. 12; pl. 5, fig. 24.

M. (*Clematissa*) *chamaeleon* (v. Koch), p. 45, pl. 4, fig. 7.

M. (*Clematissa*) *sceptrum* Studer, p. 46, p. 4, fig. 8, pl. 5, fig. 10.

M. tenue Nutting, p. 45, not figured.

Thomson gives no diagnosis of the genera. The first three forms seem to me to belong in *Paramuricea*. The last three may possibly belong in another genus, but without any material for comparison it impossible to describe the distinguishing characters. Kükenthal regards *Clematissa* as a synonym of *Muriceides*.

Aurivillius, 1931, p. 175 lists a number of species which he thinks belong in *Muriceides*. He has only examined two; one which in the present paper is referred to *Trachymuricea*, namely *T. kükenthali*. As most of his list is merely compiled from the literature it needs no further discussion.

Genus 13. Villogorgia Duchassaing & Michelotti

Syn. Paracamptogorgia Kükenthal, 1919.

For complete list of synonyms, see Aurivillius, 1931, p. 204.

Diagnosis: — Colonies profusely branching in one plane; branches and branchlets fairly slender; zooids alternating in lateral rows. Spicules in coenenchyma two to four-armed bodies (star-shaped in some Pacific forms) with a central projection composed of narrow to broad leaves with serrate margin. In the anthostele the deposits become more scale-like with two to four arms and a laciniated projecting spine. Collaret well developed with 2–4 rows; operculum with usually three rods in each section. Color dirty grey or white.

Type species: — *Villogorgia nigrescens* Duchassaing & Michelotti.

Remarks: — The genus is listed in Kükenthal's monograph, 1924, with only the type species which he had not examined. It is Aurivillius who deserves credit for realizing that the one spicule of *V. nigrescens*, which Kölliker figured in 1865, plate 17, fig. 20, belonged to the same type as those characteristic of *Paracamptogorgia* and numerous other species, known from the Indo-Pacific. Aurivillius described one species from the West Indies as new, but the enormous variability of the type species makes it impossible to separate it from the latter. Duchassaing & Michelotti's type is in Br. M.

Villogorgia nigrescens Duchassaing & Michelotti

Plate 15, figs. 1–18; plate 28, figs. 2, 2a

Villogorgia nigrescens Duchassaing & Michelotti, 1860, p. 32, pl. 4, fig. 2.—Kükenthal, 1924, p. 200.
Villogorgia antillarum Aurivillius, 1931, p. 209, pl. 4, fig. 5, text fig. 40.
Paracamptogorgia bebrycoides Riess, 1929, p. 411, pl. 8, fig. 7. (*P. bebrycoides* (v. Koch), from the Mediterranean Sea may prove to be identical with *V. nigrescens*).

The colonies branches profusely, in one plane, with occasional anastomoses. The branches and branchlets are thin, about 1 mm. in diameter and the zooids although laterally placed, are more crowded on the "ventral" side. Most of the colonies are about 10 cm. high and equally wide but there is one much larger specimen with the branches up to 3 mm. in diameter (the branchlets are broken off), and this fragment has exceptionally large spicules. The color of the colonies is dirty grey, or white. The axis is brownish and wood-like.

The spicules vary exceedingly within the same colony, and from colony to colony. The coenenchyma contains mostly four-armed crosses with a central cluster of projections which varies from irregular, rough narrow pillars to broad, thin, coxcomb-like leaves. The thornscales in the anthostele have a two to four-armed base, smooth to rough, and a projecting spine of dentate leaves. The collaret consists of three to four transverse rows of warted spindles, thickest on the middle. The operculum consists of two large rods with curved base, warted surface and laciniated tip; a smaller, unpaired rod is usually intercalated.

The spicules in the coenenchyma measure from 0.2–0.4 mm. in diameter; the thorn-scales in the verrucae measure 0.3–0.4 mm. across the base; the rods in the collaret measure 0.4–0.5 mm. and the opercular rods up to 0.5 mm. These measurements agree with those given by Riess and Aurivillius. (Riess gives lower numbers in her diagnosis than in her description of the individual colonies).

Type: — Br. M.

Type locality: — Off Guadeloupe.

Distribution: — Widespread in the West Indies. Possibly also known from off the Azores and the Mediterranean Sea.

Depth: — In the West Indies known from 56 to 262 fms.

Specimens examined: — The type and the following colonies in the M.C.Z.

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4679	45	101	Off Florida	Several
4680	132	117	" St. Croix	1
5022	155	88	" Montserrat	1

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4681	203	96	Off Martinique	1
5023	166	150	" Guadeloupe	1
4682	232	88	" St. Vincent	1
4683	241	163	" Cariacou	1
4684	249	262	" Grenada	numerous
4685	273	103	" Barbados	2
5024	276	94	" "	1
4686	290	73	" "	several
4687	292	56	" "	1
4688	296	85	" "	1
4689	297	123	" "	4

Remarks: — It is with some doubt that I have united these various specimens under one name, but several series of spicules, taken from the same colonies have shown so much variation that I have found it impossible to express any constant differences. The spicules from the large colony, collected of St. Vincent (no. 4682), are exceptionally large but similar deposits occur here and there in the smaller, typical colonies.

Very likely the species *V. bebrycoides*, from the eastern part of the Atlantic Ocean must be withdrawn under *V. nigrescens*. It is not known whether it displays a similar wide variation of its spicules.

The excellent figures given by Aurivillius, show clearly that his *V. antillarum* is a synonym of the present, common West Indian species which was redescribed by Riess in 1929 as *Paracamplogorgia bebrycoides* (v. Koch). Aurivillius died in 1928 and the editors of his paper have evidently overlooked her description.

A. antillarum was based on a single colony from Anguilla, from 70–200 fms. and has very broad thin leaves on the central projections whereas Kölliker's figure of a spicule from the type of *V. nigrescens* represents a four-armed plate with a narrow, tall central column.

Genus 14. Placogorgia Wright & Studer 1889

Diagnosis from Kükenthal, 1924, p. 209: — Colonies branching in one plane. The long branches and branchlets are bent upward, parallel with the main stem and the tips are swollen. The zooids are distributed over the entire surface,[1] most crowded at the tips. The verrucae are blunt, conical. Operculum with

[1] In poorly developed specimens they may be scattered laterally only.

two-three pointed spindles in triangular arrangement above a collaret of spinous rods, leaving a fairly large triangle free from spicules. Anthostele with large, often branched thorn scales in alternating rows. The coenenchyma contains long, blunt-ending spindles, often bent; around the base of a zooid they are circularly arranged.

Type species: — *Placogorgia atlantica* Wr. & Studer.

Remarks: — Neither Kükenthal nor Riess have examined the type species.

Key to the species of Placogorgia from the West Indian waters

1. In the coenenchyma superficially placed excessively large (4 mm.) spindles. Anastomoses frequent ..... 1. *P. mirabilis* spec. nov.
1. In the coenenchyma no superficially placed excessively large spindles. Anastomoses rare. 2.
2. The large spindles in coenenchyma are simple, with or without a single projection. Most thornscales with laciniated distal spine. Opercular rods often crutch-shaped ..... 2. *P. tenuis* (Verrill).
2. The large spindles in coenenchyma carry a series of low conical spines on the external side. Thornscales with simple divided distal spine ..... 3. *P. rudis* spec. nov.

Placogorgia mirabilis spec. nov.

Plate 6, fig. 4; Plate 12, figs. 9–12

The collection contains several specimens of a very striking species. The largest specimen (broken) must have been about 20 cm. high, with long bifurcated branches and branchlets bent upward and somewhat meandering; often anastomosing; about 1–1.5 mm. thick. The zooids are scattered irregularly over the surface, not especially crowded near the tips. They are about 0.5 mm. high, mostly with the operculum withdrawn or flattened to a low cone. The colony is externally covered by huge, white spindles often absent in the lower part of the colony which may be due to the fact that they have fallen off as they are very easily removed. Beneath them, the colony is a matted felt of small spindles, with or without an outer projection, resembling the kind of spicules one finds in *P. tenuis* (Verrill). The low, rounded verrucae contain several rows of thorn scales with distinctly blunt spine. In the collaret there are a few rows of curved spinous spindles, and the low operculum contains two-three rods in each division.

The color of the colony is greyish-brown with snow-white spindles scattered over the surface.

The large external spindles may be as much as 4 mm. in length. The small spindles in the inner layer measure about 0.40–0.50 mm., the thorn scales about

0.30 mm., and the spindles in the collaret and operculum are about 0.25–0.30 mm. in length.

Type: — M.C.Z. cat. no. 4666.

Type locality: — Off Dry Tortugas, in 101 fms. ("Blake" Sta. 45).

Specimens examined: — The type, and several other specimens and fragments from the same haul.

Remarks: — The huge superficial spindles in the upper part of the branches, and the complete inner layer of small spindles characterize this species. Aside from the large spindles, which so easily drop off, it somewhat resembles *P. tenuis* but the verrucae are smaller, more rounded, and the thorn scales are also smaller than in the latter species.

2. Placogorgia tenuis (Verrill)

Plate **15**, figs. 19–32; Plate **30**

Paramuricea tenuis Verrill, 1883, p. 38. — Kükenthal, 1919, p. 761; 1924, p. 225.

? Placogorgia atlantica Riess, 1929, p. 415, pl. 8, fig. 8. — Kükenthal, 1924, p. 209. Nec *P. atlantica* (Wright & Studer).

? Placogorgia polybrachis Riess, 1929, p. 417, pl. 8, fig. 9.

The colonies reach 30 cm. in height; many are smaller. A number of main branches arise from a common stem which, in turn, give off shorter or longer branchlets, usually slightly thicker at the tips, and situated in the same plane, sometimes coalescent. The stem may reach a thickness of 3–4 mm.; the branches and branchlets are usually 1–1.5 mm. wide, exclusive of the zooids. The zooids are small, about 1 mm. high, usually numerous both on stem and branches, sometimes laterally placed, sometimes scattered over the entire surface. They may either be conical, with the operculum expanded, or blunt with the operculum withdrawn. The dry colony is greyish; the axis is pale brown, woodlike. The coenenchyma is covered by a dense felt of small spindles, in some cases bent and blunt, in others pointed and with a projecting outer spine. The zooids contain numerous thorn scales in alternating rows, usually with a blunt spine, more or less cleft or laciniated, and with a basal part which varies from simple bifurcate to strongly laciniated. The collaret contains a number of transverse rows of curved spinous spindles. The operculum contains two-three spindles, or, in a large number of cases, one single crutch-shaped rod, forked at the lower end, and usually laciniated in the upper end.

The spicules in the coenenchyma average 0.30–0.60 mm. in length. The

thorn scales measure about 0.40 mm., and the opercular rods and collaret spindles are of about the same size.

Type: — M.C.Z. cat. no. 4673.

Type locality: — Off Barbados, in 76 fms. ("Blake" Sta. 272).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4669	45	101	Off Florida	8
4670	241	163	" Cariacou	3
4671	220	116	" St. Lucia	1
4672	249	262	" Grenada	2
4673	272	76	" Barbados	4
4674	276	94	" "	6
4677	277	106	" "	1
4675	292	56	" "	1
4676	296	84–125	" "	3

Remarks: — This extremely variable species seems to be identical with what Kükenthal (1924) and Riess' (1929) regard as *Placogorgia atlantica*, as well as with P. *polybrachis* Riess. Their specimens were all collected off Barbados in 100 fms. (most likely "Hassler" Expedition material). The figures given of the colonies agree well with the variable exterior of the present species, and the measurements are also fairly similar, but no figures are given of the spicules. It is remarkable that the peculiar single rod in the operculum is not mentioned, but Verrill also evidently overlooked that feature when he first described the species.

I doubt very much whether this species is actually identical with the one described from St. Paul's Rock by Wright & Studer, but it is impossible to make sure without comparison with the type.

3. Placogorgia rudis spec. nov.

Plate **15**, figs. 33–34

The collection contains three small colonies as much as 10 cm. high, with mostly a dichotomous mode of branching, and in one plane. The branches are about 0.15 mm. wide. The zooids are small, about 1 mm. high, and are scattered over the surface, not specially crowded toward the tips. The coenenchyma is covered by a single layer of large white spindles most of which carry a row of low, conical projections on their outer side. The verrucae have one-two circles of thorn plates with spinulated, blunt, divided tooth and broad laciniated base. The

collaret has a few transverse rows of curved spindles, and in the operculum are two-three rods. All the deposits are profusely spinulated.

The color is white or grey, the axis is brown.

The spindles in the coenenchyma measure about 0.9 mm., the thorn scales between 0.45 and 0.9 mm.; the collaret spindles about 0.5 mm., and the opercular rods may be as long as 0.9 mm.

Type: — M.C.Z. cat. no. 4665.

Type locality: — Off Barbados, in 94 fms. ("Blake" Sta. 276).

Specimens examined: — Three from the type locality.

Note: — Other species in the Atlantic Ocean.

Placogorgia atlantica Wright & Studer, 1889, p. 114, pl. 23, fig. 5; pl. 27, fig. 2.

Type: — Br. M.

Type locality: — St. Paul's Rock, Atlantic Ocean.

Remarks: — No specimens have been examined, but it seems to differ from the species which occur in the West Indian waters.

Genus 15. Echinomuricea Verrill 1869

Diagnosis: — Colonies branching in one plane with verrucae crowded toward the tip of the branchlets and mostly absent on the "dorsal" side. Zooids have several rows of projecting, sharply pointed thornscales. Operculum with one pair of large curved spindles in each division and one or two smaller spindles between the larger ones. Collaret with a few rods of spindles. Coenenchyma with warted spindles of extremely variable size, with or without projecting spines.

Type species: — *E. coccinea* (Stimpson).

Remarks: — Kükenthal (1924, p. 185) gives the distribution of the genus as exclusively Indo-Pacific, but from Thomson's description of *E. atlantica* (Johnson), from off the Azores (1927, p. 40), it seems as if that species at least belongs to *Echinomuricea*, as defined for the present moment. It seems also to occur in deeper waters in the West Indies. (The other species of *Echinomuricea* which Thomson lists seem, however, to be various species of *Paramuricea* (see below)).

Echinomuricea atlantica (Johnson)

Plate 12, figs. 16–22

Acanthogorgia atlantica Johnson, 1862a, p. 194, 5 text figs.

Echinomuricea atlantica Thomson, 1927, p. 40, pl. 4, fig. 3.

The collection contains a large number of specimens which I have referred to Johnson's species, hitherto reported only from the eastern part of the Atlantic Ocean.

The largest colony measures 23 cm. in height and 15 cm. in breadth. The stem gives off branches with upward bending branchlets, all in one plane. The verrucae are crowded, except on the basal part of the stem and on the "dorsal" part both of the stem and branches. The verrucae are low and covered by numerous projecting conical spines. The operculum contains one pair of rods, and sometimes a smaller, unpaired rod in each section. In the collaret are three transverse rows of spindles. The coenenchyma is covered by thick spindles, often with one or more projecting spines. The size and armature of these spindles vary from branch to branch and from colony to colony. The thorn scales in the verrucae likewise vary much in shape, but the projecting spine is always thick. The basal plate is irregular, with indented margin and rough surface, and is thickest in the middle.

The color of the colony when dry is pale white or grey; the axis is pale grey, wood-like.

The spicules in the coenenchyma may be a few mm. long. The largest thorn scales measure 0.9 mm., and the opercular and collaret spindles are about half as large.

Type: — Br. M.

Type locality: — Off Madeira.

Specimens examined:

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4652	45	101	Off Florida	7
4653	171	163	" Cariacou	1
4654	232	88	" St. Vincent	1
4655	241	163	" Grenada	1
4656	249	262	" "	2
4657	254	164	" "	1
4658	269	124	" St. Vincent	1
4659	271	458	" Bequia	1
4660	273	103	" Barbados	1
4661	277	106	" "	3
4662	295	120	" "	1
4663	298	120	" "	1
4664	299	123	" "	2

Remarks: — The species described above, resembles exactly Thomson's *E. atlantica*. Johnson's original description is rather brief, and Kükenthal (1924 p. 225) places *atlantica* without further comment in *Paramuricea*, and suggests it is merely a synonym of *placomus*.

Note: — Four species of *Echinomuricea* are reported by Thomson (1927) in addition to *E. atlantica* (Johnson), from the eastern Atlantic. As far as I am able to estimate from the descriptions and figures, they are all various species of *Paramuricea*.

E. borealis, p, 40, probably a *Paramuricea*. *P. borealis* Verrill is a synonym of *P. placomus* (Linnaeus).

E. annectens and *intermedia* Thomson, p. 41, probably *P. placomus* (Linnaeus).

E. scolopendra Thomson, p. 43. The spicules figured resemble those found in *P. grandis* Verrill.

Filigella Gray 1868

Syn. Elasmogorgia Wright & Studer, 1889.

A diagnosis and a key to the five species known is given by Aurivillius, 1931, p. 126.

Type species: — *F. gracilis* Gray.

According to Aurivillius the genus is identical with *Elasmogorgia* Wright & Studer. Four of the species known are Indo Pacific; the fifth, and type species, is some very poor fragments, which have been very thoroughly examined and redescribed by Aurivillius.

Filigella gracilis Gray

Filigella gracilis Gray, 1868, p. 443, text fig. 2.—Verrill, 1912, p. 390. — Aurivillius, 1931, p. 137, text fig. 26.

Gray's and Aurivillius' descriptions are used: It is an unbranched very slender fragment with cupulate verrucae more close to one side. The spicules in the outer layer are clumsy, those in the inner are smaller and more fusiform. In the walls of the zooids many spicules are clubshaped. The collaret has 3–4 rows, the operculum 3–4 pairs in each section. Tentacles with lateral and dorsal spicules. Colorless, with transparent spicules.

The larger spicules measure 0.38–0.19 mm, the smaller ones 0.27–0.15 mm, collaret and opercular spindles 0.3–0.2 mm.

Type: — Br. M.

Type locality: — Off Cape Frio, Brazil, no depth given ("with Pennatulacea").

Distribution: — Known from the type locality only.

Specimens examined: — The types.

Remarks: — The type specimens which lack bases are very likely degenerate fragments. To judge from the spicules they resemble some poor *Swiftia*, although none of the species which I have seen, have the zooids so widely separated as Gray indicates ("¾–1 inches apart"). Aurivillius comments on the affinity to certain species of *Stenogorgia*. He places the genus in Muriceidae, but thinks it, with *Stenogorgia africana* Kükenthal, should possibly be placed in a separate genus in the family Gorgoniidae.

Anthomuricea Wright & Studer 1887

For diagnosis, etc., see Kükenthal, 1924, p. 166.

The genus comprises 9 species, all Indo-Pacific. A tenth has recently been described from the West Indian waters by Aurivillius. It may possibly turn out to belong in another genus.

Anthomuricea antillarum Aurivillius

Anthomuricea antillarum Aurivillius, 1931, p. 120, text fig. 23.

Type: — Riksmuseum, Stockholm.

Type locality: — Anguilla, W. I.

Remarks: — Aurivillius' description of the type, an unbranched fragment, 13 cm. in length, with dome shaped calicles, and the operculum mostly projecting into a high peak, and his figures of the slender spicules, recall *Swiftia exserta*, which however, always seems to be branched. It seems somewhat doubtful whether the specimen is an *Anthomuricea*.

Family 7. ACANTHOGORGIIDAE

Diagnosis, from Kükenthal, 1919, p. 298: — Holaxonia with almost pure horny axis. The zooids not divided into a verruca and an upper soft part which may be retracted into the lower part. The zooids are large and have eight rows of spinous spindles arranged crosswise. No operculum nor collaret. The typical spicule form of the coenenchyma is the elongate spindle.

Remarks: — The family includes two genera: *Acanthogorgia* I. E. Gray and

Acalycigorgia Kükenthal, the latter occurring in Japanese waters and off the Nicobars, and the former in the Indo-Pacific as well as in the Atlantic Ocean. The members of the two genera are littoral, or belong to the coast abyssal. See Kükenthal, 1924, pp. 237–252. Aurivillius has recently (1931, p. 50) transferred what he considers *Eumuricea* to this family.

Acanthogorgia Gray 1857

Diagnosis: — The colonies branch chiefly in one plane. The zooids occur on all sides or are placed more or less in the plane of the branches. The zooids are large, unable to retract, and without distinct operculum. They are covered by long spindles arranged crosswise in eight rows, the upper ones projecting as spines over the oral disk. The cortex contains spindles of similar form, and in the deeper layer are small, often star-shaped, deposits. The axis is uncalcified.

Type species: — *Acanthogorgia aspera* Pourtalès.

Distribution: — Atlantic and Indo-Pacific, deep littoral to coast-abyss.

Remarks: — Kükenthal (1924, p. 239) lists twenty-eight certain and nine uncertain species. The genus is represented in the Atlantic Ocean by two forms from the Bay of Biscay, three from the Azores and Madeira, and three from the West Indies (one, *P. armata*, is reported also from the waters off South Africa). The east Atlantic species seem all to be closely related to the West Indian species. (See p. 153).

Key to the species of Acanthogorgia, known from the western Atlantic

1. Zooids 6–8 mm. high. Colony with few, widely diverging branches; spicules slender.... 1. *A. armata* Verrill.
1. Zooids at utmost 3 mm. high.....2.
2. Zooids crowded on all sides of the stem and long branches; colony sparingly branched, with mostly long branches and branchlets which are bent upward, candlestick-like. Projecting marginal spines smooth .....2. *A. aspera* Pourtalès
2. Zooids usually not crowded; mostly in a single row on each side of the stem and branches; sometimes more crowded near the tips. Colonies richly branched in irregular fashion, branchlets mostly short. Projecting marginal spines with low projections..... 3. *A. schrammi* (Duchassaing & Michelotti).

1. Acanthogorgia armata Verrill

Plate 16, figs. 1–4.

Acanthogorgia armata Verrill, 1878, p. 376; 1883, p. 31, pl. 3, figs. 1–1b, 2–2a–b. — Kükenthal, 1919, p. 733; 1924, p. 249.

A. verrilli Studer, 1901, p. 44, pl. 7, figs. 4–6.

There are in the collection several specimens of this northern form, which is included in the present paper for the sake of comparison, and because it may eventually be found to occur in West Indian waters. The specimens are about 10 cm. in height with a few diverging branches. The zooids may be as much as 6 mm. high and are arranged in a loose spiral on the stem; toward the tips of the branches they become crowded. The zooids seem to be normally trumpet-shaped, narrow at the base, and widest at the tip where the contracted tentacles form eight lobes. The spicules are arranged crosswise in eight bands; only the marginal ones seem to project beyond the skin. The color of the colonies is dirty white. The axis is pale yellow and fibrous.

The thin coenenchyma contains long, slender, almost straight, slightly spinous rods; similar rods form the armature of the zooids. The marginal spines have a smooth free portion and a relatively long spinous inner portion. In the base of the tentacles are numerous short spinous rods.

The coenenchyma spicules are as long as 1.5 mm.; those in the zooids are of the same length. The marginal spicules may be as much as 1.1 mm. in length.

Type: — U.S.N.M.

Type locality: — Off Nova Scotia, in 300 fms.

Specimens examined: — Several specimens from lat. 40° 11′ 40″ N. and long. 68° 22′ W. in 304 fms. ("Blake" Sta. 309); M.C.Z. cat. no. 4701.

Remarks: — *Acanthogorgia verrilli* Studer (1901, p. 44, pl. 7, figs. 4–6) collected off Newfoundland is based upon a young specimen. Studer's figures of the spicules of *A. verrilli* agree absolutely with those of *A. armata* (it must be admitted, however, that Verrill's figures are not very clear), and I have therefore united the two species.

2. Acanthogorgia aspera Pourtalès

Plate **16**, figs. 14–27; Plate **31**, figs. 2, 2a

Acanthogorgia aspera Pourtalès, 1867, p. 113. — Verrill, 1883, p. 33. — Studer, 1901, p. 44. — Kükenthal, 1924, p. 244.

Non *A. aspera* Hedlund, 1898, p. 3, pl. 1, fig. 1, see Kükenthal, 1924, p. 244.

Non *A. aspera* Nutting, 1910b, p. 15.

Non *A. aspera* Thomson & Henderson, 1906, p. 47, pl. 2, fig. 2; pl. 5, fig. 15.

Paramuricea hirta? Hargitt & Rogers, 1901, p. 281 (nec *P. hirta* Pourtalès).

The collection contains a small immature specimen (with degenerate spicules), probably the type, and also three small and three large specimens with well-developed spicules. The latter are as much as 20 cm. in height. They have a few long branches and branchlets, bent upward and densely covered with

zooids, 1–3 mm. high and 1 mm. wide, which are bristling with spines. The smallest specimen is 5 cm. high, and unbranched.

The color of the colonies is dirty grey or white; the axis is pale brown and fibrous, woodlike.

The spicules in the coenenchyma are mostly simple, spinous rods; a few crosses may occur. The zooids contain similar rods but generally with one end smooth and perforating the integument. Marginal rods are present in a multiples of eight, usually two-three rods in each tuft. These rods have a perfectly smooth outer projection and a strongly warted base, spinous in most cases. The base of the tentacles contain numerous short, spinous rods.

The coenenchyma spicules are about 0.6 mm. in length, the crosses 0.3 mm. The rods in the zooids vary from about 1.0 to 1.20 mm.

Type: — M.C.Z. cat. no. 4702.

Type locality: — Off Havana, in 270 fms. ("Bache" expedition).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4703	188	372	Off Dominica	1 young
4704	224	114	" St. Vincent	2
4708	288	399	" Barbados	1 fragment
4705	290	73	" "	2
4706	"Hassler" Exp.	100	" "	3
4702	"Bache" Exp.	270	" Havana	1
4707	Fish Hawk Sta. 6067	97–120	" Porto Rico	1 fragment

Remarks: — The species is easily recognized on account of the large number of smooth projecting spines in the zooids, the simple branching, and the density of the zooids.

Studer's *Acanthogorgia aspera* from 927 m., off the Azores, may be a different species, or possibly a deep sea variety. No figures of it are given.

3. Acanthogorgia schrammi (Duchassaing & Michelotti)

Plate 16, figs. 5–13; Plate 31, figs. 1, 1a

Blepharogorgia schrammi Duchassaing & Michelotti, 1864, p. 15, pl. 1, fig. 9.
Acanthogorgia muricata Verrill, 1883, p. 34. — Kükenthal, 1924, p. 243.
A. schrammi Kükenthal, 1924, p. 252.
A. goësi Aurivillius, 1931, p. 83, text fig. 18, pl. 2, fig. 3.
Non *A. muricata* Hiles, 1899, p. 48, pl. 1, figs. 6–7, see Kükenthal, 1924, p. 243.
Non *A. muricata* Studer, 1901, p. 45.
Non *A. muricata* Thomson & Simpson, 1909, p. 192.
Non *A. muricata* var. *indica* Thomson & Henderson, 1905, p. 290. — Kükenthal, 1924, p. 251.

The collection contains two specimens and some fragments of this species which, according to Verrill's earlier papers, is quite common off Barbados at a depth of about 100 fms. The specimens are as much as 25 cm. high, with slender stem and numerous delicate branches and branchlets, all in one plane. The zooids are slender, cylindrical, and scattered along the sides, opposite or alternating, somewhat more crowded near the tips. They are about 2 mm. high, distinctly higher than the thickness of the thin branches upon which they are placed. The margin of the zooids contains eight long, rough, projecting spines.

The color of the colony is whitish; the axis is pale brown, fibrous.

The coenenchyma contains warted spindles, crosses, and branched deposits. In the zooids are warted spindles, often bent, and arranged crosswise, but rarely perforating the skin except those in the margin, which have a warted spinous base and a long, strong projection with low spinous base and a long, strong projection with low spines almost the entire length. The base of the tentacles contains small spinous rods.

The projecting marginal spines may be as much as 1.35 mm. in length; the spindles in the sides of the zooids, 0.8 mm., and those in the coenenchyma 0.6 mm. The crosses may be as large as 0.25 by 0.20 mm.

Type: — Apparently lost.

Type locality: — Off Guadeloupe.

Specimens examined: — Two specimens from 94 fms. off Barbados ("Blake" Sta. 276), and one specimen and some fragments from 92 fms. in the vicinity ("Blake" Sta. 272). Also, one poor fragment from 164 fms. off Grenada ("Blake" Sta. 240); M.C.Z. cat. no. 4709–4711.

Remarks: — This species is the only one of the West Indian forms which seems typically to have isolated zooids in alternate rows and only eight marginal spines. I have therefore not hesitated to place Verrill's *A. muricata* as a synonym of Duchassaing & Michelotti's well characterized species. The only difference seems to be that the axis in their specimen was dark.

It is impossible to tell whether Studer's *A. muricata*, collected off the Azores, is identical with the present species, as no figures are given. Studer does not mention the cross-shaped or branched spicules, nor the low number of marginal spines. His statement that the projecting spines are very smooth seems to indicate that his determination is wrong; possibly he had *A. aspera* Pourtalès before him.

A. goësi was described by Aurivillius from Anguilla, W. I., 100–150 fms.

Note:—Regarding the species of *Acanthogorgia* described from the eastern part of the Atlantic Ocean: —

A. hirsuta Gray, 1857, p. 128, pl. 3, fig. 2 (erroneously labeled *Nidalia*).— Johnson, 1861, p. 297.— Studer, 1901, p. 46.— This form seems to be identical with *A. aspera* Pourtalès, but the two forms should be compared directly before the matter can be decided.

A. aspera Studer, 1901, p. 44.— Possibly identical with the typical form, or a variety, with smaller spicules. No figures are given.

A. muricata Studer, 1901, p. 45.— Probably *A. aspera*, since the projecting spines are described as very smooth.

A. horrida Studer, 1901, p. 46, pl. 7, figs. 1–3.— Seems nearest to *A. aspera* with its numerous zooids, smooth spines, and short branched base on the marginal spines.

A. truncata Studer, 1901, p. 46, pl. 6, figs. 5–8.— Seems to be a young specimen of *A. aspera*, except for the fact that the projecting spine is figured with irregular surface, but Studer states in his text that "la pointe est longue et lisse."

[A list of the Atlantic forms is found in Aurivillius, 1931, p. 86 with brief discussion.]

Family 8. PRIMNOIDAE

The family is thoroughly treated by Kükenthal, 1919, pp. 301–485; 1924, pp. 252–321.

Diagnosis: — Colonies feather-like, or tree-like; often dichotomously branching; in some forms, whip-like. Zooids single, paired, or in whorls; not retractile, and covered by large scales. Operculum present; rudimentary in one genus only. (*Primnoides*). Central core of axis thin; axis with horny lamellae, alternating with calcareous lamellae; surface smooth, lustrous.

Remarks: — The family occurs in the Indo-Pacific, Atlantic, and Antarctic Oceans; deep littoral to abyssal forms. It is divided into twelve genera, eight of which occur in the West Indies, off Brazil, and off the coast of New England. The key includes all the genera known.

List of Primnoidae known from the West Indies

Plumarella pourtalesii (Verrill).

P. pourtalesii var. *robusta* nov. var.

Caligorgia gracilis (Milne-Edwards).

C. verticillata (Pallas).

Primnoella polita spec. nov. (= *P. distans* Studer (partim).

Thouarella aurea spec. nov.

T. goësi Aurivillius.

Stenella imbricata (Johnson).
Narella (Stachyodes) laxa spec. nov.
N. pauciflora spec. nov.
N. regularis (Duchassaing & Michelotti).
Calyptrophora trilepis (Pourtalès).

From the eastern part of the Atlantic Ocean are listed the following species (Kükenthal, 1919; 1924).—
Caligorgia verticillata (Pallas).
C. grimaldi Th. Studer (possibly identical with *C. verticillata*).
Stenella imbricata (Johnson).
Stachyodes (Narella) bellissima Kükenthal [=N. *regularis* (Duchassaing & Michelotti)].
Calyptrophora josephinae Lindstrom.

Thomson (1927) has added: —
Caligorgia flabellum (Ehrenberg).
Thouarella variabilis Wright & Studer.
T. hilgendorphi Studer.
Stachyodes versluysi (Hickson).
S. almanni Wright & Studer.

Key to the genera of Primnoidae

From Kükenthal (1924, p. 252), slightly modified. —

1. Zooids with rudimentary operculum ..... (Subfam. I. *Primnoidinae*) *Primnoides*.
1. Zooids with well developed operculum ..... 2.
2. Zooids with scales of almost equal size, in as many as eight longitudinal rows ..... (Subfam. II. *Primnoinae*) 3.
2. Zooids with few scales which form more or less complete rings ..... (Subfam. IV. *Calyptrophorinae*) 10.
3. Zooids almost vertically placed, stiff, and unable to curve inward ..... (Subfam. III. *Callozostroninae*) 9.
3. Zooids bent obliquely upward; in various degrees able to curve inward ..... 4.
4. Marginal scales immovable ..... 5.
4. Marginal scales able to turn inward, over the operculum ..... 8.
5. The zooid scales form eight complete longitudinal rows ..... 1. *Plumarella*.
5. The zooid scales form less than eight complete rows; often eight marginal scales present. 6.
6. The adaxial part of the zooid is covered with scales almost as large as the abaxial scales. *Pseudoplumarella*.

6. The adaxial part of the zooid has no scales, or is covered by small scales.....
7. The zooids are closely and irregularly crowded together; sometimes directed downward on the branches.....2. *Primnoa.*
7. The zooids are placed in whorls on the branches.....3. *Caligorgia.*
8. The slightly differentiated, small, opercular scales are overreached by the large abaxial marginal scales. Colonies whip-like, or sparingly branched. Zooids appressed, with small scales on the adaxial side.....4. *Primnoella.*
8. The well differentiated, large, opercular scales are not overreached by the marginal scales. Branched forms, carrying cylindrical to club-shaped zooids with scales well developed on all sides, resembling fir cones.....5. *Thouarella.*
9. The zooids are arranged in closely successive whorls with not less than eight zooids.... *Callozostron.*
9. The zooids stand isolated, in pairs, or in whorls with as many as five zooids; the whorls widely separated.....6. *Stenella.*
10. With three-four pairs of large abaxial scales, dorsally separated..7. *Narella* (*Stachyodes*).
10. With two pairs of large abaxial scales.....11.
11. With one pair of abaxial infrabasal scales; large scales dorsally fused..8. *Calyptrophora.*
11. With three pairs of abaxial infrabasal scales; large scales more or less separated..... *Arthrogorgia.*

Eight genera are represented in the western Atlantic Ocean. For all others see Kükenthal, 1924 (and 1919).

Subfamily I. Primnoinae

Genus 1. Plumarella Gray 1870

Diagnosis: — Colony branching feather-like, in one plane, alternating; sometimes the branches again bifurcating. Zooids rarely in pairs, mostly alternating, never in whorls. Zooid scales in eight complete rows, and only slightly sculptured. Marginal scales immovable, of same shape as the other scales, or strengthened by a short median projection. Operculum well-developed. Coenenchyma sclerites as scales, sometimes more rod-shaped. An inner layer contains smaller roundish or irregular forms.

Type species: — *Plumarella penna* (Lamarck).

Remarks: — Kükenthal lists sixteen certain species, two varieties, and two uncertain species. The genus is chiefly represented in Japanese and adjacent waters.

From the Atlantic Ocean one species was previously known, occurring in the West Indian waters. A variety is added in this paper.

1. Plumarella pourtalesii (Verrill)

Plate 25, figs. 17–18; Plate 26, fig. 10, 10a

Primnoa pourtalesii Verrill, 1883, p. 28, pl. 2, figs. 2, 2a–c.
Plumarella pourtalesii, Kükenthal, 1919, p. 345; 1924, p. 257 (complete list of references).

The type and a large fragment show the same characteristic outer features. The colony branches in one plane, and has one-two main stems which give off regularly slender branches in a pinnate manner, alternating at a distance of about 1 cm. Sometimes these branches may bifurcate again. The largest fragment is about 15 cm. high, with a stem 1.5 mm. wide near the base. The upper part of the stem is about as wide as the branches (0.5 mm.). The zooids are about 1 mm. long and 1–2 mm. apart, alternating, obliquely placed on the edge, and all directed toward one side. They are slightly conical, smooth, trim, with a low conical operculum, and contain eight longitudinal rows of scales in five-six transverse rows. The coenenchyma is covered with similar plates.

Color of the colony, yellow to white; axis, honey-colored, glossy.

Spicules as thin plates with smooth to dentate margin and low warts radiating out from the center, and present in various numbers. The opercular scales are triangular with dentate edge and similar warts or spines radiating out from a point near the base. The coenenchyma scales are roundish or irregular.

The scales and plates may be as much as 0.25 mm. in length; the opercular scales, 0.35 mm.

Type: — In M.C.Z. (cat. no. 4821).

Type locality: — Off South Carolina, in 337 fms. ("Blake" Sta. 318).

Specimens examined: — The type, and a larger specimen, both from 125 fms. off Florida (Pourtalès Gulf Stream Explor.); also, a branch from 324 fms. off Bahia Honda (M.C.Z. cat. no. 4822).

Distribution: — Off South Carolina, off Florida, and most likely off Porto Rico (Hargitt & Rogers' specimen not in U.S.N.M.); depth 125–513 fms.

1a. Plumarella pourtalesii Verrill var. robusta var. nov.

Plate 25, figs. 14–16; Plate 26, fig. 9

The collection contains a somewhat stouter specimen of *P. pourtalesii* with thicker, more sculptured spicules, and with distinct longitudinal ridges on the opercular scales; operculum flatter.

It is labeled from 18 fms. off Alligator Reef, Florida (Pourtalès, coll. M.C.Z. cat. no. 4823). It seems to be merely a more robust variety of *P. pourtalesii*, but it is very doubtful whether the extremely shallow depth is correct.

Genus 2. Primnoa Lamouroux 1912

For complete list of references, see Kükenthal, 1924, p. 265.

Diagnosis: — Tall colonies with long branches and branchlets upward bent. The entire surface except the base of the colony is covered by large scale-covered zooids in irregular order. The zooids are covered by scales on their external side while the adaxial side is almost without them. The anthostele has eight marginal scales and the anthocodia has eight opercular scales. The stem is covered by irregular plates.

Type species: — *P. resedaeformis* (Gunnerus).

Remarks: — Only one species is known, from the northern part of the Atlantic Ocean as well as from the northern part of the Pacific Ocean, where a variety furthermore has been described from off Japan. A doubtful species, with smaller zooids has been reported from off British Columbia.

1. Primnoa resedaeformis (Gunnerus)

For complete list of references see Kükenthal, 1924, 0. 266. Also Verrill, 1922, p. 14, pl. 4, figs. 4–8; pl. 9, fig. 1. — Aurivillus, 1931, p. 293, text fig. 58. — Kramp, 1932, p. 16 (discussion of distribution only).

Diagnosis: — As for the genus.

Type: — Probably lost.

Type locality: — Coast of Norway.

Distribution: — "Principal occurrence in the deep part of the warm Atlantic area, although it does not apparently descend very far into the abyssal region,— occurs also in the littoral region; in the eastern Atlantic it penetrates rather far towards the North; occur in fiords as well as in the open sea." (Kramp, 1932, p. 16). Known from the southwest coast of Greenland (Kramp, 1932) and as far south as the Gulf of Maine. (Verrill 1922).

Depth: — From 100 to about 200 fms.

Specimens examined: — Three colonies from off the coast of Maine, M.C.Z. cat. no. 4787.

Genus 3. Caligorgia Gray 1857

For complete list of references, etc., see Kükenthal, 1919, p. 362; 1924, p. 267.

Diagnosis: — Colonies usually large, flabelliform; branches pinnate, the terminal branchlets simple, long, slender, nearly parallel; sometimes unbranched. Verrucae in whorls, incurved, appressed, with the rows of scales on the adaxial side reduced, or partially lacking; outer and lateral surfaces usually with about four rows of overlapping scales; generally five or more in each longitudinal row, their exposed edges usually serrate or spinulose. Opercular scales thin, of various forms, usually minutely spinulose or granulose.

Type species:—*Caligorgia verticillata* (Pallas).

Remarks: — Kükenthal recognizes twenty-three species as valid, and four which he considers doubtful; keys are given (1919, p. 364; 1924, p. 268).

From the West Indian region two species are known, both represented in the "Blake" material. Two others are reported from the eastern part of the Atlantic Ocean. See p. 16.

Key to the species of Caligorgia known from West Indian waters

1. Zooids almost cylindrical, with high conical operculum. Scales fairly smooth; one lateral scale present on each side. Four-seven abaxial scales in each row. Opercular scales with a long hollow tooth..... 1. *Caligorgia gracilis* (M. Edwards).

1. Zooids distinctly club-shaped with low operculum. Scales with strongly developed ridges and marginal teeth. Outer lateral row represented by two-three scales; inner lateral row by one-two scales. Eight-ten abaxial scales in each row. Opercular scales triangular, the upper part deepened into a furrow, visible as a keel on the inner side..... 2. *Caligorgia verticillata* (Pallas).

1. Caligorgia gracilis (Milne-Edwards)

Plate 25, figs. 4, 10–11; Plate 26, fig. 7

For literature, etc., see Kükenthal, 1919, p. 375; 1924, p. 273.

There are many specimens of this form in the collection. It is a species which superficially resembles *C. verticillata*, being about the same size (at least 60–70 cm. in height), with a feather-like branching, and a similar arrangement of zooids. Usually the whorls are close, with only three-five zooids in a whorl, but there may be as many as seven. The distinguishing characters are: the almost cylindrical zooids, the high pointed operculum, the almost smooth scales from

five-seven in number, and the apparently single lateral scale. The surface of the verrucinal scales is reticulated and the edge dentate. The opercular scales have a distinct furrowed tooth and no radiating furrows on the lower part of the scale. The coenenchyma scales are roundish on the larger branches and gradually become more slender and rod-like on the finer branches arranged parallel to the axis.

The opercular scales average about 0.35 mm.; the abaxial scales are smaller. The abaxial scales, in a middle-sized specimen, are about 0.30 mm. broad.

Type: — Possibly in Paris.

Type locality: — West Indies.

Distribution: — Off Jamaica and the Windward Islands.

Depth: — From about 56 to 175 fms.

Specimens examined: —

M.C.Z. Cat No.	*"Blake" Exp.*	*Depth (fms.)*	*Locality*	*Specimens*
4788	155	88	Off Montserrat	Fragments
4789	220	116	" St. Lucia	"
4790	224	116	" St. Vincent	"
4791	241	163	" Cariacou	"
4792	272	76	" Barbados	"
4793	276	94	" "	"
4794	290	73	" "	"
4795	292	56	" "	"
4796	293	130	" "	"
4797	296	85	" "	"
4798	Bartlett coll., (1880); entrance to Port Royal, Jamaica; 100 fms., 1 specimen.			
4832	Sigsbee coll.; off Havana; 243–450 fms.			

Remarks: — This material agrees in every respect with the description given by Kükenthal.

2. Caligorgia verticillata (Pallas)

Plate **25**, figs. 5–9; Plate **26**, fig. 6

For list of references, etc., see Kükenthal, 1919, p. 371; 1924, p. 270. — Aurivillius, 1931, p. 257, text fig. 50.

This common West Indian form is abundantly represented in the collection. None of the specimens is complete, but the largest ones must have been about 1 m. high. It is a straight erect form, usually with a single stem which gives off long branches in a feather-like fashion. They diverge at about 30 degrees,

approximately 1 cm. apart, and are placed in one plane. Occasionally, a secondary stem may be given off in the same plane.

The stem is strongly compressed. The verrucae are about 1–1.2 mm. high and placed in whorls, three or four to seven in each whorl, sometimes in close succession, sometimes a few mm. apart. They are strongly incurved and distinctly club-shaped. Normally they are directed upward, but now and then a branch may be found with some of the whorls directed downward.

In alcohol, the colony is pure white or yellowish. The axis is rigid, yellow, and glistening.

The zooids contain eight-ten abaxial scales in two rows. The broadest ones, strongly curved and fairly smooth, occur near the base. The scales in the distal rows have long, strong ridges which give them a peculiar appearance. There are two-three scales in the outer lateral row in the upper part of the verrucae, and one-two scales in the inner lateral row. The adaxial rows are represented by two marginal scales which usually are not visible when the zooid is attached.

The operculum consists of eight triangular scales, the adaxial ones somewhat smaller. The coenenchyma is covered by small plates or rods, the latter predominating, on the distal part of the branches.

The distal abaxial scales have about five-seven strong ridges or spines along the margin; sometimes they diverge from a center. Occasionally there are two-three rows of spines. The lower abaxial scales and the scales in the other rows are covered by small warts which sometimes form a network. The opercular scales have dentate edges, and a number of ridges and furrows diverging from near the base. The edges along the apex are somewhat raised, thus deepening the intervening portion into a furrow which is apparent in the form of a keel on the inner side of the scale.

The deposits of the coenenchyma are fairly thick, irregular to oblong, plates with irregular margin and covered by small tubercles which apparently never unite into stronger ridges.

The large opercular scales are about 0.35 mm. in length; Kükenthal says as much as 0.4 mm. The larger scales and the deposits in the coenenchyma are about 0.30 mm. long, or smaller.

Type: — Most likely lost.

Type locality: — Mediterranean Sea.

Distribution: — Off Florida and the Windward Islands; reported also from the eastern part of the Atlantic. Depth, in the West Indian waters, from 120 to 288 fms.

Remarks: — Kükenthal's description was based on M.C.Z. material. This species was formerly considered as restricted to the eastern part of the Atlantic, and it is on his authority that I refer the specimens listed below to Pallas's species.

Species examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4816	208	213	Off Martinique	Fragments
4817	216	154	" St. Lucia	"
4828	233	174	" St. Vincent	"
4818	269	124	" Grenada	"
4819	281	288	" Barbados	"
4820	U. S. Coast Survey	130	" Florida	"
4829	No locality	No depth		"
4830	Pourtalès, Coll.	120	" Sand Key	"

Note: — Other species of Caligorgia, reported from the Atlantic Ocean.

Caligorgia flabellum (Ehrb.)

For literature, etc., see Kükenthal, 1919, p. 372; 1924, p. 271.

This form was previously listed from the West Indies (Duchassaing & Michelotti, Avad. Sci. Turin, Ser. 11, tome 19, p. 17), but most likely they did not have *C. flabellum* before them, but *C. verticillata.*

C. flabellum is, however, reported by Stephens (1910) off the Irish coast, and by Thomson (1927) from 638–660 m. off Mogador and Cape Verde. It differs apparently from *C. verticillata* in having fewer zooids in the whorls (three-four), and only two lateral scales instead of two rows in the upper part of the zooid. The surface of the coenenchyma scales also seems to be more sculptured (see Versluys, 1906, p. 70, fig. 78). According to Thomson, the species often shows a tendency to a more dichotomous mode of branching.

Caligorgia grimaldii (Th. Studer)

See Kükenthal, 1919, p. 370; 1924, p. 270. — Aurivillius, 1931, p. 259, text fig. 51.

Apparently closely related to, or identical with *C. verticillata;* collected off the Azores.

Genus 4. Primnoella Gray 1857

For list of references, etc., see Kükenthal, 1919, p. 384; 1924, p. 279.

Diagnosis: — Primnoids, simple or dichotomously branched; the typical species are long, slender, wand-like, unbranched; a few species are branched. Verrucae in whorls, rather closely appressed to the stalk, directed distally. The abaxial or outer side is covered by two regular rows of large scales, usually five or more in a row. On the adaxial side the rows of scales are fewer or partly obsolete. Opercular scales are small, triangular; those on the adaxial side are also small. Coenenchyma is closely covered by small scales.

Type species: — *Primnoella australasia* J. E. Gray.

Southern Hemisphere, West Indies; continental forms.

Remarks: — Kükenthal recognizes fourteen valid species and one uncertain. The only species hitherto taken in West Indian and Brazilian waters was *P. distans* Studer, reported by the "Challenger" off Sombrero Island. Kükenthal has pointed out certain differences between the type, taken in Australian waters by the "Thetys," and the West Indian species, and thinks that they should be separated. In his notes Verrill describes one species, *P. polita*, identical with the West Indian form, hitherto passing under the name of *P. distans*. Studer's species has therefore been dropped from the list of West Indian corals.

Key to the species of Primnoella, known from the western part of the Atlantic Ocean

1. Zooids with 6–8 scales in each abaxial row. Whorls with 3–4 zooids..... 1. *P. polita* spec. nov.

1. Zooids with 10–16 scales in each abaxial row. Whorls with 5–7 zooids..... 2. *P. delicatissima* Kükenthal.

1. Primnoella polita spec. nov.

Plate 26, fig. 12

P. distans (partim) Wright & Studer, 1889, p. 85, pl. 17, fig. 1.

Colony consisting of a simple, slender stem; length of only entire specimen, 145 mm.; diameter of base, 5 mm.; of axis, 2.5 mm.; length of verrucae, 1.5 to 1.75 mm.; their diameter, about 0.3 mm. The base of one specimen in the collection consists of several irregular, lobed or root-like, divergent processes which are white and stony, and were evidently attached to the substratum. Axis terete, very smooth, partly calcareous and sometimes rigid, almost filiform; yellowish white toward the base, white and setiform toward the tip. Coenenchyma thin,

filled with rather thin, regularly imbricated, rounded, elliptical scales, the distal end evenly and obtusely rounded, with the middle portion minutely spinulose. The zooids are elongated, mostly arranged in whorls of three, rarely of four; ascending, and closely appressed against the stem; the whorls are usually separated by intervals about equal to, but sometimes greater than the length of the verrucae; sometimes less, where new whorls have been interposed.

The verrucae are flattened, narrow at the base, regularly enlarging toward the summit. They are entirely covered abaxially by two rows of alternating, relatively large, polished, imbricated scales, usually six to eight scales in each row; distal end of scales broadly rounded. A row of scales on each side consists of smaller and fewer plates, not visible dorsally; adaxial rows of scales largely abortive. Opercular scales are acute-triangular, forming a low operculum; their free edges are usually irregularly denticulate or lacerate, but this condition may be due in part to injury, for in some cases they are entire.

Type: — M.C.Z. Cat. no. 4799.

Type locality: — Off Frederickstad, St. Croix, in 504 fathoms. ("Blake" Sta. 136).

Distribution: — West Indies; Pernambuco, Brazil, (Wright & Studer.)

Specimens examined: — Three fragments from St. Croix.

Depth: — From 120 to 504 fms.

2. Primnoella delicatissima Kükenthal

Primnoella delicatissima Kükenthal, 1908, p. 47; 1919, p. 402; 1924, p. 286. — Aurivillius, 1931, p. 276, text fig. 55.

The unbranched colonies hitherto described measure up to 35 cm. in height; the zooids form well spaced whorls with 5–6 zooids in each. The zooids in Kükenthal's colonies measured up to 1 mm. in height and had 10–12 scales in each abaxial row, while the colonies which Aurivillius examined had zooids which were up 1.5 mm. high, and had up to 16 scales in each abaxial row.

Type: — In Munich.

Type locality: — Off Cape Frio, Brazil; no depth indicated.

Distribution: — Known from off Cape Frio and the vicinity of Rio de Janeiro.

Depth: — Aurivillius' colonies came from 30–40 fms. depth.

Specimens examined: — None.

Remarks: — It is possible that *P. delicatissima* represents the shallow water form of *P. polita*. At the present moment the two species seem well separated.

Genus 5. Thouarella Gray 1870

Diagnosis: — Primnoids with various modes of branching; zooids single, in pairs, or in whorls, and obliquely bent upward; cylindrical, or club-shaped, with scales usually in less than eight longitudinal rows, but always with marginal scales which may be bent inward over the well-developed operculum. Scales often with a projecting spine. Coenenchyma covered by scales.

Type species: — *Thouarella antarctica* (Gray).

Mostly in the Antarctic; in the Atlantic, the genus occurs in West Indian waters and off the Azores; in the Pacific, it reaches as far north as the coasts of Japan. Kükenthal (1924) lists twenty-nine certain species, and seven uncertain.

Key to the species known from West Indian waters

1. Verrucinal scales smooth, roundish, in six-seven transverse rows. One of the marginal scales has a long slender projecting tooth ..... 2. *Thouarella aurea* spec. nov.
1. Verrucinal scales thick, in four-five transverse rows, and with excentric fasciculated projection ..... 1. *Thouarella goëssi* (Aurivillius).

1. Thouarella goësi (Aurivillius)

Plate **25**, fig 2, 19–23; Plate **26**, fig. 8

Plumarella goëssi Aurivillius, 1931, p. 244, pl. 5, fig. 6, text fig. 47.

The most complete of the few specimens in the collection is 10 cm. high, with a single slender zigzag bent stem and alternating branches, diverging at about 45 degrees, placed in one plane, and sometimes bifurcating. The zooids are about 1 mm. long, and are arranged alternately on the stem equidistant from each other. As in *Plumarella* they are placed along the side of the branch and bent toward one side, so that there is a distinct back and front side to the colony.

The color of the colony is pure white; the axis, golden, iridescent.

The zooids resemble short pine cones. They have about five longitudinal rows of scales arranged in four-five transverse rows. The scales are thick and bear a projection, especially long in the marginal scales, which sometimes may be bent over the operculum. The operculum is low, almost flat. The coenenchyma is covered by small scales which bear a low central projection.

The scales have a dentate margin, and the excentric projection is composed of a number of long pillars or spines. Sometimes smaller spines are scattered over the surface. The opercular scales lack these projections but have a dentate margin and longitudinal furrows. The coenenchyma scales resemble the verrucinal scales, but the projection is short and centrally placed.

The longest scales average about 0.35 mm.; the opercular scales, about 0.30 mm. The average coenenchyma scales are 0.15 mm. in diameter.

Type: — Riksmuseum, no. 28, Stockholm.

Type locality: — Virgin Islands, W. I.; 250–300 fms.

Specimens examined: — One from off Havana, 175 fms. Blake Sta. 56. (According to Verrill's manuscript, also taken by the "Albatross" in the same waters.)

Remarks: — In Verrill's manuscript this species is placed in a new genus, but as far as I can see it belongs to *Thouarella*. The scales seem to be somewhat thicker than those in the species figured by Kükenthal in his monograph, but without any other specimens for comparison it is impossible to comment further. It may be a new subgenus.

It seems to be distinctly different from the two species of *Thouarella* which Thomson describes from the Atlantic Ocean (1927, p. 33).

Aurivillius discusses this aberrant form at length. He calls attention to its resemblance to certain species of *Thouarella*, although he places it in *Plumarella*.

2. Thouarella aurea spec. nov.

Plate 25, fig. 12–13; Plate 26, fig. 11

Several small specimens and some large fragments are in the collection. The largest fragments are about 10 cm. long. It is a flexible, loose-pinnately branched form, the single branches separated by about 1 cm. and often branched again. The zooids, about 1 mm. high and separated by approximately that distance, are arranged as in *Plumarella*, with the openings turned to one side. They are distinctly bell-shaped, broadest at the tip, with a variable number of projecting spines along the margin, and are closed by an operculum.

The color of the colony is pale yellow; the retracted tentacles, seen between the opercular plates, dark brown; the axis, golden, iridescent.

The spicules are arranged approximately as in *Plumarella pourtalesii*. They are thin, smooth plates with almost even margin and no radiating furrows. There are a variable number of small knobs in the center of each plate. One or more of the marginal scales bear a long tapering smooth spine. The opercular scales are oblong plates. The coenenchyma scales are of the same type as the verrucinal scales.

The larger scales are about 0.25 mm. in diameter; the marginal scales may be as much as 0.50 mm., including the spine. Many scales are only 0.15 mm. in diameter.

Type: — In M.C.Z. Cat. no. 4801.

Type locality: — Off Bahia Honda, Florida, in 310 fms., according to Verrill's manuscript. The specimens are merely labeled, "Pourtalès, coll."; the particular depth does not appear in the list of stations.

Specimens examined: — Five broken specimens from the type locality.

Remarks: — The species is easily characterized by its projecting spines and smooth scales.

Note: — Thomson, 1927, p. 33, reports two species from deep water (1165–1642 meters) in the eastern Atlantic, previously known from the Antarctic and Indo-Pacific. These forms may consequently be expected in West Indian waters. They are *Thouarella variabilis* Wright & Studer; off the Cape Verde Islands and the Azores; depth, 1250–1642 m., and *Thouarella hilgendorfi* Studer; off Azores and Cape Verde; depth 1156–1494 m. (One record from 69 m. is undoubtedly incorrect).

Subfamily II. Callozostroninae

Genus 6. Stenella Gray 1870

For list of references, etc., see Kükenthal, 1919, p. 443; 1924, p. 302.

Diagnosis: — Primnoids which branch dichotomously, mostly in one plane, with slender forking branchlets. Verrucae on the branches mostly opposite, in two series, sometimes in whorls, rarely alternate; they are prominent, clavate, not appressed, nearly symmetrical, covered with several pairs of large, curved, overlapping scales. The marginal scales are larger, varying in number, often four, usually with flaring margins, sometimes with spiniform tips. Operculum conical, composed of eight triangular, usually curved scales. Coenenchyma thin, covered with rather large, overlapping scales of various forms.

Type species: — *Stenella imbricata* (Johnson).

Remarks: — Kükenthal recognizes eight species. The genus is widely distributed in deep water in all the warmer seas.

The various species differ considerably in the structure of the verrucae, and especially in the number of marginal scales, which vary from four to eight. The more typical species usually have four marginal scales; some have eight, with the two adaxial ones smaller than the others.

The type species belongs to the West Indian fauna. It was first taken by the "Blake" expedition, and a brief note on this find was included in Kükenthal's paper (1919, p. 448).

1. Stenella imbricata (Johnson)

Plate 26, fig. 5

Primnoa imbricata Johnson, 1862, p. 245.

Stenella imbricata Kükenthal, 1919, p. 448; 1924, p. 305. Complete list of references.—Thomson, 1927, p. 32, pl. 2, fig. 9; pl. 3, figs. 9, 31; pl. 5, figs. 5–6.

Several fragments are in the collection, but no complete specimen. Apparently the larger colonies were about 40–50 cm. high. It is a rigid, brittle form with numerous short branches and branchlets, dichotomously dividing and mostly in one plane. The stem or main branch is about 3 mm. in diameter, and the branches and branchlets about 1 mm. wide. The zooids are rigid, about 3 mm. high, perpendicular to the stem, and not crowded (usually separated by a few mm.); occur either in pairs or in whorls of three-four.

The colony is pure white in alcohol; the axis, pale yellow and glossy.

The zooids are trumpet-shaped and covered by three rows of scales, the basal pair squarish, often with flaring edges; some smaller scales also present; the distal pair the largest. The operculum is composed of oblong scales with outward bending margin; the coenenchyma is covered by scales, often with projecting edges or keels.

It seems to be almost a rule for some part of the colony to be deformed by an annelid, belonging to the Hesionidae. Under this condition the scales on one side of the branches grow out into large plates which curve together so that they form a practically closed canal. The zooid scales, especially the basal ones, are often deformed in a similar way. The phenomenon has been described and figured by Johnson who considered it a normal feature. Similar galls are also found in *S. helminthophora* Nutting from the Pacific Ocean (1908, p. 575).

Type: — Br. M.

Type locality: — Off Madeira, in deep water.

Distribution: — Eastern part of the Atlantic, and West Indies; deep water (500–1000 fms.).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4802	2	805	Off Morro Castle	Fragments
4803	41	860	" N.W. of Cuba	"
4804	131	585	" St. Croix	"
4805	227	572	" St. Vincent	"
4806	268	955	" Grenada	"

Remarks: — Kükenthal's specimen from the "Blake" expedition is undoubtedly identical with the fragments from off Morro Castle, Cuba (not Moro-coast, as it appeared in his papers of 1919 and 1924).

Note: — Other species of *Stenella* in the Atlantic Ocean — *Stenella johnsoni* Wright & Studer, 1889, p. 57, pl. 13, fig. 3; pl. 20, fig. 6. This species is closely related to *S. imbricata*, but the zooids are in pairs, and there are no flaring edges on the opercular scales which form only a slightly prominent cone.

Subfamily III. Calyptrophorinae

(*Syn. Stachyodinae*)

Genus 7. Narella Gray 1870

Narella Gray, 1870 b, p. 49.
Stachyodes Th. Studer, 1887, see Kükenthal, 1919, p. 452; 1924, p. 308, (complete list of references).

Diagnosis: — A much branched primnoid, usually flabellate; branches pinnate or bipinnate. Zooids in pairs or in whorls, usually turned downward; their walls are formed by 3–4 pairs of large separate scales, usually not coalescent so as to complete the covering of the adaxial side, especially not the basal pair. Coenenchyma thin, with rather large, thin scales, varying in form.

Type: — *Narella regularis* (Duch. & Mich.), 1860.

Remarks: — *Primnoa regularis* (Duch. & Mich.) was redescribed and also figured by Kölliker (1865, p. 135) who studied the type. *Stachyodes* Wright and Studer, 1889, is a synonym of *Narella* Gray 1870.

Kükenthal (1919, p. 453) gives a complete key to the hitherto known species of *Narella* under *Stachyodes*. For some reason he does not include *Stachyodes regularis* among the definite species. He wrongly includes *Calyptrophora trilepis* in the genus.

Key to the species of Narella from the West Indies

1. Whorls closely set, with seven-eight zooids; colony fan-shaped..... 1. *Narella regularis* (Duchassaing & Michelotti).
1. Whorls well spaced, with three-five zooids.....
2. Three pairs of scales beside the basal pair in the zooids.....2. *N. laxa* spec. nov.
2. Two pairs of scales beside the basal pair in the zooids.....3. *N. paueiflora* spec. nov.

1. Narella regularis (Duchassaing & Michelotti)

Plate 26, fig. 3

Primnoa regularis Duchassaing & Michelotti, 1860, p. 17, pl. 1, figs. 12–13. — Kölliker, 1865, p. 135.
Stachyodes regularis Kükenthal, 1919, p. 466 (complete list of references); 1924, p. 316.
S. trilepis Th. Studer, 1901, p. 41, pl. 5, pl. 11, figs. 3, 6, 7.
S. bellissima Kükenthal, 1915, p. 154; 1919, p. 457; 1924, p. 310.
Non *Stachyodes regularis* Wright & Studer, 1889, p. 55, pl. 11, figs. 2–2a; pl. 20, figs. 3 (from the Kermadec Islands).

Several branches of this very characteristic form are in the collection. The colonies evidently grow large, about 30–50 cm. in height and the same in breadth. The branches lie in one plane, apparently arising from one side. The whorls are closely set, and form rings of seven-eight zooids around the slightly flattened stem.

The color is white in alcohol; the axis, pale straw-colored and iridescent.

The zooids are bent downward almost perpendicularly; the operculum often directed inward, and slightly irregular, its outer scales being somewhat larger. There is one pair of large basal scales, with a projecting squarish tip and a distinct longitudinal ridge; a pair of smaller scales, almost forming a short cylinder; and a pair of distal scales with somewhat projecting tips. The verrucae are about 2 mm. long. The opercular scales have a median furrow and somewhat flaring edges. The coenenchyma is covered by oblong plates, often with projecting, thin edges.

Type: — Possibly in Turin (re-examined by Kölliker, 1865).

Type locality: — Off Guadeloupe; no depth given.

Distribution: — West Indies, and off the Azores.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4807	232	88	Off St. Vincent	8 fragment
4808	233	174	" " "	2 "

Remarks: — Duchassaing & Michelotti's species has hitherto been regarded as doubtful, but the figure which the two authors give cannot represent any other species. A large beautiful complete specimen has been taken off the Azores, and is figured as *trilepis* in Studer's paper (1901). Kükenthal later (1915) re-named Studer's species "*bellissima*," a name which obviously must be dropped.

2. Narella laxa spec. nov.

Plate **26**, fig. 1

The single specimen in the collection branches dichotomously, dividing near the base into eight large, rather upright branches, most of which do not branch again. The branches lie nearly in one plane. The zooids are arranged rather regularly in whorls of three to five; the whorls well-spaced, at distance about equal to length of verrucae, often more. The verrucae are turned downward; rather large and long, enlarged distally, convex abaxially, angulated, and narrowed near the basal pair of large scales, which project considerably and have their free margins rounded. The two or three intermediate pairs of scales are large, the proximal pair longer and narrower; the distal or marginal scales broader and more flaring. The opercular plates are large, triangular, arranged in pairs; the adaxial plates, smaller.

Color in alcohol, yellowish white.

Type: — U. S. N. M., Cat. no. 11853.

Type locality: — Lat. 40° 34′ 18″ N.; long. 66° 00′ W; depth, 1742 fms.

Specimens examined: — Fragment of the type (M.C.Z. Cat. no. 4811).

3. Narella pauciflora spec. nov.

Plate **25**, fig. 3; Plate **26**, fig. 2

The collection contains a few branches, as much as 20 cm. in length, which fork repeatedly in the same plane. The verrucae on the stronger branches are arranged four-five in a whorl; on the smaller branches, either three in a whorl, or opposite. They are bent downward and separated by a distance of about 3 mm. between the base of two zooids.

The stem is greyish-yellow, glistening, hard, and calcareous. The color of the colony is pure white.

The zooids are 2.5–3 mm. long. There is one pair of large basal scales, the outer margin of which projects only slightly, a pair of smaller median scales, and a pair of larger distal scales. The operculum is high and well-developed, with median furrow and flaring edges. The coenenchyma is covered by irregular scales, mostly squarish oblong.

Type: — M.C.Z. cat. no. 4809.

Type locality: — Off St. Croix ("Blake" Sta. 124); in 580 fms. Also taken off St. Vincent in 573 fms. ("Blake" Sta. 227); M.C.Z. cat. no. 4810.

Remarks: — I have been unable to identify this species with any other form known from the Atlantic Ocean.

Note: — Other species of Narella (Stachyodes) from the Atlantic Ocean. *Narella versluysi* Hickson, see Thomson, 1927, p. 30. — Kükenthal, 1919, p. 456. Usually unbranched, with six-ten zooids in the whorls on the branches, fourteen zooids in the whorls near base; off the Azores. According to Thomson, *N. almanni* Roule, 1896, p. 303 is possibly identical with this species. *Narelli almanni* Wright & Studer; Thomson (1927, p. 29) lists this species, which was previously known from the Indo-Pacific, as occuring off the Azores; he gives no figures. Wright & Studer's illustration 1889 (pl. 11, figs. 1–1a) shows a species with fairly close-set whorls and flaring edges on all three pairs of scales.

Genus 8. Calyptrophora Gray 1866

Diagnosis, from Kükenthal 1919, p. 468: — The colony branches dichotomously; the main branches may branch feather-like to one side, and these branches and the branchlets may form different planes with each other so that the colony becomes a composite fan. The zooids are arranged in whorls, and the oral opening is directed ventrally (in *C. japonica* sometimes turned upward). The base of the zooid is covered by one pair of small infrabasal scales, followed by two pairs of larger scales which adaxially are either free or have coalesced into a ring. Small adaxial buccal scales may be present, or lacking; oral scales form a relatively high operculum. The spicules of the coenenchyma are scale-like, and form a single layer.

Indo-Pacific and Atlantic Ocean; deep sea forms.

Type species: — *Calyptrophora japonica* Gray.

Remarks: — Kükenthal (1924, p. 317) lists five certain species to which *C. trilepis* (Pourtalès) must be added (he referred it to *Stachyodes*).

In the Atlantic Ocean, two species, closely related, are known to occur; one of these is recorded from the West Indies.

Calyptrophora trilepis (Pourtalès)

Plate **25**, fig. 1; Plate **26**, fig. 4

Primnoa trilepis Pourtalès, 1868, p. 130.

Calyptrophora trilepis Gray, 1870, p. 42. — Lindström, 1877, p. 7.

Stachyodes trilepis Versluys, 1906, p. 122. — Kükenthal, 1919, p. 465.

Non *Stachyodes trilepis* Studer, 1901, p. 41 (=*Stachyodes regularis* Duchassaing & Michelotti.)

Pourtalès' description: — "Branches irregularly and sparsely dichotomous, subflabellate. Branchlets very thin and flexible. Calicles in verticils of four, or more generally five, formed of three large cylindrical scales, joined angularly to each other like the elbows of a stove pipe downward bent. Aperture closed by eight triangular scales. The distance between the verticils is equal to or a little less than the length of the single polyps. The coenenchym is very thin and covered with irregular imbricated scales. Axis hard and brittle, brown in the thicker branches and yellow in the younger. By its simplified scales, this species makes an approach to the genus Calyptrophora Gray."

A few small branches, five or six inches long, were obtained in 324 fms. off Bahia Honda, Florida (Pourtalès Gulf Stream Explor.).

Type: — A fragment of the type is in the M.C.Z. (cat. no. 4812). Most of the colony is, however, lost.

Remarks: — Lindström (1877, p. 6) has pointed out the differences between *C. trilepis* and *C. josephinae*. In *trilepis*, the large distal scales are united so that only a suture indicates the place where they have coalesced; the basal scales do not project in a point, but form a rounded edge; the scales of the stem are large.

Kükenthal (1919) places *C. trilepis* in Stachyodes, but does so incorrectly. Studer's *trilepis* is identical with *Stachyodes regularis* (Duch. & Mich.). See p. 169.

Note: — From the eastern Atlantic is known. —

Calyptrophora josephinae Lindström

Calyptrophora josephinae Lindström, 1877, p. 6, pl. 1, figs. 1–3. — Studer, 1901, p. 41. — Thomson, 1927, p. 29. — Kükenthal, 1929, p. 219. — Aurivillius, 1931, p. 301, pl. 6, fig. 5; text fig. 60.

Type: — Riksmuseum, Stockholm.

Type locality: — Josephine Bank, Lat. N. 36° 6′ 7″. Long. W. 14° 7′ 22″, 110–117 fms.

Various specimens of this form have been taken off Portugal and off the Azores in 200–300 m. The differences between this species and the foregoing, *C. trilepis*, have already been pointed out by Lindström (see above), and it seems almost certain that the two forms are distinct. If they should be united, Pourtalès' name has the priority.

Family 9. GORGONIIDAE

Diagnosis, from Kükenthal, 1919, p. 850: — Colonies branching mostly in one plane, laterally, alternating, or in pairs, rarely dichotomously. Anastomoses are often present. The zooids are usually absent near the base, and occur chiefly

in two lateral rows on stem and branches. They form low verrucae (which may be completely retractile), and are armed with small irregularly warted or smooth spindles. The coenenchyma always contains small spindles and double spindles, in most cases with warts arranged in transverse rows, and from those forms may develop the half-moon shaped scaphoids or the disk-carrying spindles. The axis is usually horny, transparent, sometimes more fibrous.

Remarks: — The family occurs in all seas, and ranges from shallow water to the coast abyssal. Kükenthal (1924) treats the entire family briefly; Bielschowsky (1929) describes the West Indian forms in great detail.

Of the eleven genera, seven occur in the West Indian region, including Brazil. Twenty-one species are described in the following pages, two of which seem to be new. Very few additions can be expected in the future, as most of the species are conspicuous shallow water forms which early attracted the attention of collectors.

List of Gorgoniidae known from the West Indies and Brazil

Gorgonia hartti Verrill
Leptogorgia hebes (Verrill)
L. setacea (Pallas)
L. miniata (Val.)
L. purpurea (Pallas)
L. sanguinolenta (Pallas)
L. virgulata (Lamarck)
Swiftia casta Verrill
S. pourtalesii nom. nov.
S. koreni (Wright & Studer)
S. exserta (Ellis & Solander)
S. spec.
Pterogorgia acerosa (Pallas), and varieties
P. bipinnata Verrill
P. sparsiramosa Bielschowsky
P. americana (Gmelin)
P. ellisiana Milne-Edwards
Rhipidogorgia flabellum (Linnaeus)
Xiphigorgia anceps (Pallas)
X. citrina (Esper)
Phyllogorgia dilatata (Esper)

Key to the genera of Gorgoniidae[1]

From Kükenthal (and Bielschowsky), 1919, p. 850; 1924, p. 321.

1. Branches of the colony cylindrical or flattened ..... 2.
1. Branches leaf-like expanded, or triangular in cross section ..... 9.
2. The coenenchyma contains only small spindles with regular rows of warts ..... 3.
2. The coenenchyma contains either large irregularly warted spindles; or spindles with regular rows of warts together with scaphoids; or spindles in which the warts have become transformed into disks ..... 5.
3. Colony with numerous anastomoses ..... *Gorgonia L.*
3. Colony usually without any anastomoses ..... 4.
4. Zooids arranged on all sides of the cylindrical terminal branchlets ..... *Lophogorgia* H. Milne-Edwards.
4. Zooids laterally arranged on the flattened terminal branchlets ..... 2. *Leptogorgia* H. Milne-Edwards.
5. The coenenchyma contains large spindles without regular arrangement of the warts .... 3. *Swiftia* Duchassaing & Michelotti.
5. The coenenchyma contains no large spindles with warts irregularly distributed, but only small spindles with regularly arranged warts and, besides, either disk spindles or scaphoids ..... 6.
6. The coenenchyma contains disk spindles ..... *Eugorgia* Verrill.
6. The coenenchyma contains scaphoids ..... 7.
7. Anastomoses are frequent ..... 4. *Rhipidogorgia* Linnaeus.
7. Anastomoses are absent ..... 8.
8. Scaphoids are warted near their blunt ends ..... *Pseudopterogorgia* Kükenthal.
8. Scaphoids not warted at their ends ..... 5. *Pterogorgia* (Ehr.).
9. Zooids arranged on the margin of the leaf-like expansion of the branches ..... 6. *Xiphigorgia* H. Milne-Edwards.
9. Zooids arranged on the surface of the leaf-like expansion of the branches ..... 10.
10. Axis branched ..... 7. *Phyllogorgia* H. Milne-Edwards.
10. Axis expanded as a lamella in the leaf-like branches ..... *Phycogorgia* Valenciennes.

Genus 1. Gorgonia Linnaeus 1758

Diagnosis: — Reticulated, fanlike colonies with zooids forming low verrucae on the surface of the branchlets, or being completely contractile. Spicules, shorter or longer spindles blunt or pointed sometimes slightly curved with warts in belts. Axis horny. Color red or yellow.

Type species: — *G. ventalina* Linnæus.

[1] Regard ing the genera which do not occur in the West Indies, see Kükenthal, 1924, p. 321 *et seq.*

Remarks: — The members of this genus are shallow water forms. Ten species are reported from the west coast of Central America. One species is known from the coast of Brazil.[1]

Gorgonia hartti Verrill

Gorgonia hartti Verrill, 1912, p. 391, pl. 29, figs. 6, 6a; pl. 30, fig. 2; pl. 33, fig. 6; pl. 35, fig. 6.

The type specimen was about 20 cm. high and 34 cm. wide. A fragment less than 1 cm. square is all that has been examined. It is a dark red, regularly reticulated form. The marginal branchlets are less than 1. cm. in diameter and the meshes are 3–4 mm. across. The spicules consists of two types, a pointed, often slightly curved, larger form with two large belts of warts and a more indistinct belt toward the points, and a shorter, blunt form with two large central belts and a terminal cluster of warts. Due to the scarcity of material, it could not be ascertained whether there were any spicules in the operculum. A few flat rods were observed but they may have come from the coenenchyma.[2] The larger pointed spindles measure about 0.12 mm, the shorter blunt ones, 0.08 mm.

Type: — Yale Museum (small fragment).

Type locality: — Maranhao, Brazil.

Distribution: — Known from the type locality only.

Remarks: — The only species known in the area included which has a regularly fanshaped, reticulated colony, excepting only *Rhipidogorgia* which has entirely different spicules. It does not show any close affinities to the known species of Gorgonia from the west coast of Central America.

Specimens examined: — Fragment of the type.

Genus 2. Leptogorgia H. Milne-Edwards 1857

Diagnosis, from Kükenthal, 1924, p. 324: — Colonies branching mostly in one plane, laterally, occasionally dichotomously. Anastomoses may be present. The terminal branchlets are almost always developed on both sides, feather-like in their arrangement. When developed on one side only they may grow extremely long, whip-like. Branches and branchlets often flattened. Zooids biserially ar-

[1] Verrill, 1912, lists two other species as belonging in *Gorgonia;* viz., *G. braziliensis* and *G. gracilis,* synonyms of *Leptogorgia setacea* (Pallas) and *Pterogorgia bipinnata* Verrill.

[2] Verrill figures some bright yellow scaphoids, but these have undoubtedly come from some other species, examined at the same time.

ranged with low verrucae or none; orifice oblong, slit-like. Coenenchyma spicules as girdled spindles; sometimes the warts fuse together and form disks. Color brown, yellow, red, and violet; often mottled.

Type species: — *Leptogorgia petechizans* (Pallas).

Indo-Pacific and Atlantic; shallow water and coast abyssal forms.

Remarks: — Kükenthal (1924, p. 324) lists thirty species, two varieties, and twenty-two uncertain forms, some of which are shown beyond to be valid. Bielschowsky (1929) has given a thorough treatment of the whole family. Six species are included in the present paper, all descriptions being based upon material in the M.C.Z. Practically all the doubtful species have been reduced to synonymy.

A number of littoral forms are described by Kükenthal and Bielschowsky from the west coast of Africa. Some of them seem to be closely related to the West Indian forms, but actual comparison of the material may prove that they are distinctly different.

Key to the species of Leptogorgia from the West Indies

1. Colonies band-like, unbranched or with relatively few long, whip-like branches.....2.
1. Colonies branched, branches not long and whip-like.....3.
2. Colonies slender, up to 2 mm. long, normally unbranched.....
Spicules large warted bodies, often slightly curved.....
Color orange, red, yellow, or mixed.....2. *L. setacea* (Pallas).
2. Colonies with several long slender branches. Spicules short, straight rods with two-four belts of warts. Color yellow, or red, or mixed.....1. *L. virgulata* (Lam.)
3. Zooids scattered, wart-like. Spicules clumsy egg-shaped bodies with numerous small irregular clusters of warts. Color red.....4. *L. miniata* (Valenciennes).
3. Zooids numerous. Spicules with large clusters of warts.....4.
4. Zooids mostly completely retracted, not wart-like (except on the stem). Spicules straight thick bodies with two-four belts of large warts. Color yellow or red. Large form.....
3. *L. hebes* Verrill.
4. Zooids wart-like, not able to contract completely.....5.
5. Colonies closely pinnately branched. Zooids as small warts, usually crowded in thick bands along the edges. Spicules large, often slightly curved. In tentacles, rods with low warts. Color violet, or yellow and violet.....5. *L. sanguinolenta* (Pallas).
5. Colonies loosely pinnately branched.....6.
6. Zooids in a single row along the edges of the thin branchlets. Spicules slender, with numerous belts; often curved. Tentacles with pointed, flat, colorless rods. Color rusty red.
7. *L. sp.*
6. Zooids in two-four rows along the edges of the branchlets. Spicules short straight bodies with two-four belts of warts. Tentacles with flat, smooth, red rods. Color red.....
6. *L. purpurea* (Pallas).

1. Leptogorgia virgulata (Lam.)

Plate 19, figs. 24–34.

For literature see Kükenthal, 1919, p. 771; 1924, p. 334.

Leptogorgia floridana Verrill, 1864, p. 31.

L. tenuis Verrill, 1864a, p. 9.

L. teres Verrill, 1869d, p. 420 (typographical error for *L. tenuis*).

? *Xiphigorgia setacea* Kükenthal, 1916, p. 502, pl. 23, fig. 6, text fig. Z and A¹; 1924, p. 358. Nec *L. setacea* (Pallas).

Gorgonia flavida Duchassaing & Michelotti, 1860, p. 32, pl. 3, figs. 11–13. — Bielschowsky, 1929, p. 134.

This species was not taken by the "Blake" expedition, but it is discussed briefly here, as this very variable form is widely spread in the West Indies, and has been described under various names.

It is a sparingly branched form, usually with several long branches arising from one side; sometimes they are opposite. The branches form a large angle with the stem and bend upward. The stem and branches are of almost equal thickness. The zooids occur in more or less crowded rows along the sides, leaving a narrow strip or furrow between the rows or scattered all over the stem. The zooids may either form low warts or be completely retracted, forming more or less oblong slits.

The colonies vary much in size and stoutness. Specimens from Beaufort, where the species is common, may be very short and stout, or long and slender.

The color varies from yellow to red; in some places yellow with red verrucae; sometimes these are yellow tipped.

The largest specimens are about 96 cm. high, and in these cases the stem is about 5 mm. wide, while the branches taper off to 1–2 mm. The small stout specimens from Beaufort are 15 cm. high, with stem and branches about 2–3 mm. wide. The average specimens are 40 cm. high, with stem 3 mm. wide and branches 3–2 mm. wide.

The spicules are of the usual type; that is,— spindles with several rows of thick bundles of warts. They measure from 0.5 to 0.15 mm. in length. In the tentacles a few flat rods.

Type: — Possibly in Paris.

Type locality: — Coast of North America.

Distribution: — Off Jamaica (Hargitt & Rogers, 1901); off Florida (L. *floridana* Verrill), M.C.Z. cat. no. 5027; and up to North Carolina (M.C.Z. cat. nos.

5028–5033). Reported also from the Harbor of New York, and described as *tenuis* Verrill ("teres," typ. error); M.C.Z. cat. no. 5050.

As far as I can see Kükenthal's specimen of *Xiphigorgia setacea* from Honduras is really this species.

Specimens examined: — Numerous colonies in the M.C.Z. collections, ranging from Florida to North Carolina (and the Harbor of New York).

Remarks: — In spite of the great variation in form and color which this species exhibits, it has been impossible to separate it into different species or varieties. The specimens with their numerous zooids resemble very much *Lophogorgia*, as the zooids spread over the entire surface. It may eventually be referred to that genus, which has not yet been reported from the West Indies. It is certain that *G. flavida* Duch. & Mich. is a synonym of this species, as fragment of the type has been examined.

This species shows closest affinities to *L. setacea* (Pallas), and it is possible that they will prove to be the same.

2. Leptogorgia setacea (Pallas)

Plate **19**, figs 35–38

Gorgonia setacea Pallas, 1766, p. 182. For other references, see Kükenthal, 1924, p. 358, and Bielschowsky, 1929, p. 226, under *Xiphigorgia*.
Leptogorgia setacea, Verrill, 1872b, p. 433.
Gorgonia brasiliensis Verrill, 1912, p. 392, pl. 29, fig. 3, pl. 33, fig. 7, pl. 35, fig. 7.
? *Leptogorgia contorta* Kükenthal, 1919, p. 915.
Leptogorgia trinidadensis Hickson, 1928, p. 416, pl. 4, fig. 7, text fig. 37.
Non *Xiphigorgia setacea* Kükenthal, 1916, p. 502.

This species is usually unbranched, and forms ribbonlike colonies as much as 2 m. (meters) in length. Some of the smaller colonies examined are 40 cm. long and about 1 mm. wide, and the zooids are arranged in a single row along each side. The basal disk is large, thin, and horny, and attached to mussel shells in the cases observed. The large specimens are 3 mm. wide, and the zooids are arranged in 2–3 rows along each side. The zooids sometimes form low warts; in other cases they are completely withdrawn, forming an oblong, slit-like opening. The axis resembles a coarse horse-hair and is brittle when dry.

The color varies from almost white to yellow-orange or red; sometimes with red zooids and yellow coenenchyma.

Some of the colonies from North Carolina and from Desterro, Brazil, are slightly branched. A gall-like thickening, caused by a barnacle, is often present.

The spicules consist of short and long bodies with two or four belts of large warts. The large bodies are often slightly curved. In the tentacles there are a few flat rods. The color of the colony is due to the color of the spicules.

The spicules are 0.07–0.14 mm. in length; the tentacle rods, about 0.07 mm. long.

Type: — Most likely lost.

Type locality: — "Mare Americanum."

Distribution: — West Indies, off the coast of Texas, Bahamas, and North and South Carolina; shallow water form. Also from Desterro, Brazil, Bahia (*L. braziliensis*), and Rio de Janeiro (*L. contorta* Kükenthal).

Specimens examined: — A large number (several hundred), growing as dense as eelgrass, collected off the coast of Texas; a few young colonies from the Bahamas, and some fragments of large colonies (some with branches and gall-like formations) from North Carolina (M.C.Z. cat. no. 5012–5014). Also, some branched colonies from Brazil (cat. no. 5099). A fragment of Verrill's type of *braziliensis*.

Remarks: — This species resembles the slender form of *L. virgulata*. The main differences seem to be the arrangement of the zooids in lateral rows, and the somewhat larger, often curved spindles, but these differences may prove to be of no value. Hickson's *L. trinidadensis* from Trinidad resembles closely the two-colored, branched colonies from Desterro, Brazil.

Kükenthal's *Xiphigorgia setacea* from off Honduras seems to be *L. virgulata*.

3. Leptogorgia hebes Verrill

Plate **17**, fig. 3; Plate **19**, figs. 16–23

Leptogorgia hebes Verrill, 1869d, p. 422.
Leptogorgia carolinensis Verrill, 1872b, p. 432.

The M.C.Z. possesses several specimens (from Beaufort, N. C., and Florida) which I refer to this species.

It is a strongly branched, flattened form, usually with several main branches which branch pinnately in one plane. The branchlets are well separated (about 5–10 mm. apart), and arise at a wide angle, thence bending upward. The zooids are arranged on the sides; on the main branches they may cover almost the whole surface. Usually, however, a distinct furrow is present here, and a wide, naked band on the branchlets. On the main branches the zooids form sometimes low warts, but normally they are completely retracted and visible only as oblong

slits. The colonies in the collection range from 20 to 50 cm. in height. The thickness of the stem and branchlets increases with the size of the colony, 5 mm. being the diameter in the small specimens and 9 mm. in the large ones.

The color varies from orange to dark red. The axis is amber-colored and horn-like in the branchlets; dull greyish-brown and more wood-like in the main branches and stem.

The spicules are red or yellow, and of the typical form, namely, spindles with more or less complete belts of complicated, spinous warts. The tentacles contain a few flat, smooth spindles with irregular edge. They range in size from about 0.05 to 0.10 mm.

Type: — Lost.

Type locality: — Off Key West, Florida.

Distribution: — Off Florida to North Carolina. Most likely common in other parts of the West Indies.

Specimens examined: — Several colonies from Beaufort, North Carolina, and from Cape Fear River, Florida; M.C.Z. cat. no. 5015–5016.

Remarks: — The specimens from Florida were not identified but agree well with Verrill's description of *L. hebes*, and also with the specimens of *L. carolinensis* in the collection. The latter name has been overlooked by Kükenthal and Bielschowsky.

4. Leptogorgia miniata (Valenciennes)

Plate 19, figs. 1–7

Gorgonia miniata, Valenciennes, 1855, p. 12. — Milne-Edwards, 1857, p. 160.
Non *Gorgonia miniata*, Pourtalès, 1868, p. 131 (see p. 188).
Non *Stenogorgia miniata*, Studer, 1901, p. 51 (see p. 189).
Non *Stenogorgia miniata*, Kükenthal, 1919, p. 642, pl. 48, fig. 91; 1924, p. 348.

Among the Gorgonians which Verrill received from Kölliker, there is a small fragment of a dull red form, labeled *G. miniata* Val., from the Antilles.

The fragment is about 6 cm. high with six branches, almost opposite to one another. Most of them are broken off, and the remaining ones are long and curved upward. The zooids are placed along the edge of the branches as low verrucae with oblong opening.

The color is dull red in the dry condition; the axis, brown and horny.

The spicules are red and resemble those found in the other forms. They are mostly thick spindles, covered with clusters of spinous warts which are

arranged in more or less distinct belts; in the tentacles smooth flat rods with dentate edges. The spicules may measure as much as 0.1 mm. in length.

Type: — In Paris.

Type locality: — Off the Antilles; no depth given.

Specimens examined: — A fragment of the type?; M.C.Z. cat. no. 5017; also a large specimen from Puerto Colombia, Colombia, in the U. S. N. M.

The present species seems to belong to *Leptogorgia*, as that genus is defined at the moment. It resembles somewhat the red species of *Stenogorgia* from the West Indies, but it lacks the large crown of warted spicules.

The "*miniatas*" of Pourtalès and Studer refer to some *Swiftia* and I have described the former beyond (see p. 188), while the latter seems to be *S. koreni* (Wright & Studer) (see p. 189), and would appear to be the same as the *S. miniata* of Kükenthal.

5. Leptogorgia sanguinolenta (Pallas)

Plate **17**, figs. 1–2; Plate **19**, figs. 39–40.

Gorgonia sanguinolenta Pallas, 1766, p. 175. — Bielschowsky, 1929, p. 138, under *Leptogorgia*, (complete list of references).

Gorgonia petechizans Duchassaing, 1870, p. 19. — Bielschowsky, 1929, p. 122, under *Leptogorgia*, (complete list of references).

? *Pterogorgia festiva* Duchassaing & Michelotti, 1864, p. 19. — Bielschowsky, 1929, p. 133, under *Leptogorgia*, (complete list of references).

Non *Gorgonia sanguinolenta* Esper 1794, p. 86, pl. 22.

The collection contains several colonies of a variable form, which Verrill long ago diagnosed as *L. sanguinolenta*. They are all more or less broken, but the largest colonies must have been 15–20 cm. high and about equally broad. They branch pinnately in one plane, and the short stem has several main branches. The branchlets are bent upward and distinctly flattened, as are also the stem and branches in most cases. The zooids are small warts, and are crowded along the edges, in some colonies leaving a wide naked band on the front and back sides; in some of the better developed colonies the two rows almost meet.

The color varies from completely violet, to yellow or white stem with violet zooids. The axis, which is distinctly flattened and band-like except in the lowermost part, is almost black near the base, and changes to a pale brown and horny appearance in the branches.

The spicules consist of shorter, more blunt rods and longer, more pointed ones with two or more distinct girdles in the middle, and irregularly acattered

warts around the ends. There are simpler rods in the inner layer. A few small flat rods are present in the basal portion of the tentacles. The spicules are white and violet.

The shorter rods measure 0.05 mm. in length; the longer, 0.12 mm. The rods in the tentacles are about 0.07 mm. long.

Type: — Most likely lost.

Type locality: — "Mare Americanum."

Specimens examined: — Some colonies, labelled Hayti, and determined as *L. sanguinolenta* by Verrill. Also, some colonies labelled West Indies, from the Essex Institute (M.C.Z. cat. nos. 5018–5019).

Remarks: — The specimens listed above seem to agree well with Pallas' description of *sanguinolenta*.

It is very likely that the form which Duchassaing called *petechizans* is identical with the present species. The latter species has recently been described by Bielschowsky as typical of the west African fauna. Whether the two forms are identical or not cannot be decided. They seem to have at least a superficial resemblance to each other, but it would be unique if a shallow water form occurred in both the eastern and western part of the Atlantic Ocean. If the two species prove to be identical, the name *sanguinolenta* has many years priority, with a definite type locality, while *petechizans* was from "locus incertus."

Esper's "*sanguinolenta*" (1794, plate 22) does not resemble any species known from the West Indian waters. Verrill (1869, p. 422) thought that the figure of *petechizans* (plate 13) represented Pallas' *sanguinolenta*,— it agrees in all respect with Pallas' short description, and that Esper's "*sanguinolenta*" was an entirely different species, wrongly labelled. See also Bielschowsky, 1929, p. 138.

6. Leptogorgia purpurea (Pallas)

Plate **17**, fig. 4; Plate **19**, figs. 8–15

Gorgonia purpurea Pallas, 1766, p. 187. — Esper, 1797, p. 159, pl. 43, figs. 1–2. — Bielschowsky, 1929, p. 104, (complete list of references).

Gorgonia pumicea Valenciennes, 1855, p. 12.

Leptogorgia pumicea Verrill, 1869, p. 422; 1912, p. 399, pl. 33, figs. 9–10; pl. 35, figs. 11.

L. rathbunii Verrill, 1912, p. 397, pl. 29, figs. 4–4a; pl. 33, fig. 11; pl. 35, figs. 9–9a.

L. rubropurpurea Verrill, 1912, p. 398, pl. 29, figs. 5–5a; pl. 30, fig. 1; pl. 33, fig. 8; pl. 35, figs. 10–10a.

Non *L. rubra* Bielschowsky, 1929, p. 92.

The numerous specimens in the collection differ greatly in outer shape and color. Most of the colonies are low and shrublike, with a short stem. The latter

divides into several main branches which spread out fan-like, sometimes in parallel planes. The branches give off pinnately several branchlets of varying length, which diverge at about 45 degrees and bend upward. Sometimes the branchlets divide again. The zooids are mostly crowded, low warts with slit-like opening. They are placed in four rows on the stem and branches, and mostly in single rows on the branchlets. A narrow or broad strip is left free on the back and front sides, and the general impression is that most of the branches are squarish in section.

The color is a varying shade of red or reddish purple. The axis is brown and horny in the stem, yellow and flexible in the branchlets. This form resembles exactly Esper's figure (1797, pl. 43) of a specimen from Pallas' collections.

A few of the colonies are higher and more loosely branched, often all of the branches in one plane, and with more scattered zooids, so that the branches appear less squarish. This form resembles exactly the one which Wright & Studer figure from Brazil.

The spicules are all red and are divided into an outer layer of warted belted spindles, and an inner layer of flat deposits with undulated to dentate edge. The latter kind occurs also in the tentacles.

The spicules measure 0.07 mm. to 0.10 mm. in length.

Type: — Most likely not existing.

Type locality: — "Mare Americanum."

Distribution: — Antilles, (Pallas, Studer), coast of South America (Esper, according to Kükenthal). Of doubtful occurrence off West Africa (Bielschowsky, 1929).

Specimens examined: — Numerous specimens from Desterro, coast of Brazil (Thayer Exp.); M.C.Z. cat. no. 5098.

Remarks: — This species is undoubtedly identical with the form which Esper 1797 figures on pl. 43. His figure gives all the essential features of this common Brazilian form, and it seems also as if Studer (1878) must have had the same thing before him. Verrill's *purpurea* from Florida is, as Studer points out, not identical with Pallas' and Esper's species. Verrill's type is in the M.C.Z., and the label was later changed to *L. floridana*. It proves to be a much branched red specimen of *L. virgulata*.

Verrill (1912) lists three species, two of which as new, from the coast of Brazil. His two new species are varieties of *L. purpurea*. The third is *L. pumicea*, which Wright & Studer correctly give as a synonym of *purpurea*. Bielschowsky (1929) does not agree with these two authors, but the specimens which she has

renamed *L. rubra*, are from the west coast of Central America and undoubtedly different from the Brazilian form, which she has not examined.

Bielschowsky lists Esper's *L. purpurea* from West Africa and doubts its occurrence in the Western Atlantic. It is impossible to ascertain whether she is dealing with the true *purpurea*. In the M.C.Z., there are several specimens of a violet *Leptogorgia* with squarish branches and branchlets which came from West Africa, and that may possibly be the species which she describes. She gives no figure of the colony.

7. Leptogorgia sp.

Plate **17**, fig. 5; Plate **19**, figs. 41–43

The "Blake" collections contain a few branches of a species of *Leptogorgia*, which is not definitely determinable. Some of the branches had been labelled *L. pourtalesii*, but they are different from that species. (See page 188.)

It is impossible to ascertain the size of the unbroken colony. One of the fragments consists of a piece of stem about 2 mm. in diameter with long, slender, diverging branches from which arise a number of branchlets in alternating order and in the same plane. The branchlets are 1–3 cm. in length, and 1–1.5 mm. in diameter. The zooids are arranged as a serrate row of verrucae along the edges of both stem and branchlets.

The color of the colony when dry is a rusty red; when moist, more orange. The axis is rigid, and pale brown in color.

The spicules in the coenenchyma consist of long slender spindles, often slightly curved and with numerous belts of warts, and also short blunt-ending rods with two belts of warts and terminal clusters. In the zooids there are numerous long, pointed, rods, with edges which are either entire or bluntly scalloped. The spicules in the coenenchyma are rusty red, often becoming more yellowish along the margin. The flat rods in the zooids are colorless.

The long spindles may be as much as 0.15 mm. in length; the short spindles, 0.10 mm.; the flat rods, 0.15 mm.

Locality: — Off St. Croix, in 38 fms. ("Blake" Sta. 127).

Specimens examined: — A few branches, M.C.Z. cat. no. 5100.

Remarks: — This species resembles most closely *L. miniata*, both in mode of branching and in the arrangement of the zooids. But the verrucae are much more numerous and smaller, the spicules in the coenenchyma differ distinctly

both in color and shape, and the smooth rods in the zooids are long, pointed, and colorless while in *L. miniata* they are short and broad and deep red in color.

It is probable that the present species has already been described, although it has been impossible to identify it with any of the forms, valid or doubtful, which Bielschowsky listed in 1929. No name has therefore been given to it for the present.

Genus 3. Swiftia Duchassaing & Michelotti 1864

Syn. *Stenogorgia* Verrill, 1888; see Kükenthal, 1924, p. 347. *Callistephanus* Wright & Studer, 1889. *Thesea* (*partim*) Verrill, 1869 d.

Diagnosis: — Colonies loosely branching, mostly in one plane with branches and branchlets upward curved. Zooids large with conical anthostele which seldom is retracted and a tall anthocodia with numerous rows of spindles. The zooids are scattered or crowded but on the tip of the branchlets two zooids are always opposed. The coenenchyma are thin and contains shorter or longer rods with spines arranged in scattered groups; long rods are also characteristic of the anthocodia. The axis is horny, flexible. The color of the colonies is red, pink or white.

Type species: — *S. exserta* (Ellis & Solander).

Remarks: — As the genus is defined here it corresponds exactly with *Stenogorgia* Verrill, as the latter genus is defined by Kükenthal. The reason why Kükenthal did not discover the close similarities between the two genera was because he overlooked Ellis & Solander's description and figure of the type species, and was misled by an unfortunate expression used by Duchassaing & Michelotti in their diagnosis of *Swiftia*.

The type species was described and figured by Ellis & Solander in 1786. Their colony was about 2 feet high and came from the "superb cabinet of the Dutchess Dowager of Portland" and very likely it is still extant in some collection in England. It was collected in the "West Indies." In 1860, Duchassaing & Michelotti mistook a colony collected off Guadeloupe, for Ellis & Solander's species and established a new genus *Thesea* for this supposed *exserta*. However, in 1864, they received a colony of the true *exserta*, from off St. Croix, and they gave, correctly, a new name to the false *exserta* from off Guadeloupe, *Thesea guadeloupensis*, and established a new genus *Swiftia* for Ellis & Solander's *exserta* with the following diagnosis:

"Polyparium cortice tenuiter squamuloso; spiculis in cortice nullis; cellulis

prominulis, mammiformibus squamoso-striatus; ore terminali polypis persistentibus exsertis, extus spiculis magnis decussatim induratis."

Furthermore they figured the two species, *Thesea guadeloupensis* and *Swiftia exserta*, side by side, on plate 2.

Due to the unfortunate expression "spiculis in cortice nullis" nobody understood what the two authors meant, and in Kükenthal's paper 1924, *Swiftia* appears as a doubtful form, possibly a Muriceid, and no reference is given to Ellis & Solander, who are the authors of *exserta*.

A species which I consider *Swiftia exserta* is well represented in the "Blake" collection and it is easy to understand what Duchassaing & Michelotti meant, when one sees the specimens, and also realizes that their descriptions were solely based on macroscopical features and to them spicules did not exist except when they were large enough to be seen with the unaided eye. In *Swiftia exserta* the coenenchyma is almost transparent, with the spicules in the outer layer forming a thin powdery crust (while in *Thesea* for example the tissue is packed full of huge, oblong plates or spindles).

As the material in the "Blake" collection includes several colonies of a species which clearly is the one which Ellis & Solander described as the "bare-headed gorgonian," *Gorgonia exserta*, and the one for which Duchassaing & Michelotti established their genus *Swiftia*, the latter has been re-established with *S. exserta* (Ellis & Solander) as the type species. Unfortunately that implies that the name *Stenogorgia* Verrill must become a synonym of *Swiftia*, since there seems to be no generic differences between *Swiftia exserta* and the various species hitherto referred to *Stenogorgia*.

Key to the species of Swiftia known from the West Indies and off New England

1. Verrucae closely crowded.....2.
1. Verrucae distinctly separated, few, and prominent.....3.
2. Spicules as slender rods or spindles, with relatively simple warts. Color white.....
1. *S. casta* (Verrill).
2. Spicules as thick rods or spindles with large complicated warts. Color red.....
2. *S. pourtalesii* nom. nov.
3. Color bright red; spicules as spinous spindles, clubs, and shorter bodies, with complicated warts.....3. *S. koreni* (Wright & Studer)
3. Color white or pale pink.....4.
4. Tentacles with large rods (0.9 mm.) in five-six rows; verrucae prominent and scattered..
4. *S. exserta* (Ellis & Solander).
4. Tentacles with small rods (0.3 mm.) in ten to sixteen rows; verrucae low and fairly closely set.....5. *S. sp.*

1. Swiftia casta (Verrill)

Plate 18, fig. 1; Plate 20, figs. 1–5

Stenogorgia casta Verrill, 1883, p. 30, pl. 2, figs. 1–1b. — Bielschowsky, 1929, p. 188.
Gorgonia exserta Pourtalès, 1867, p. 112; 1868, p. 131. — Kükenthal, 1924, p. 348. (Nec *G. exserta* Ellis & Solander.)

Colony white, slender, irregularly and dichotomously branched, the branchlets curving outward at wide angle and then becoming erect; the tips often somewhat enlarged. The type is 10 cm. high and 12 cm. wide. The verrucae are prominent, broadly conical, and form a compact row along the edges of the branches. But those in one row do not lie precisely in one plane, for they alternately face a little to the front and to the rear; those on opposite margins of the branches alternate, and as the swollen bases of the verrucae are in contact, the edges of the branches show a zigzag outline. The verrucae in preserved specimens are narrowed at the summit, and are closed by eight convergent denticles. In most cases they are surmounted by a small anthocodia formed by an ovate or roundish small cluster of incurved tentacles. The axis is horny; color of colony white.

The spicules of the surface of the coenenchyma cannot be seen distinctly with a hand lens, but under the microscope they appear as closely packed, imbedded, small, short, mostly irregular spindles, with a slightly rough, warted outer surface.

For the most part the inner spindles are arranged obliquely and longitudinally; those that cover the verrucae are of nearly the same form, but distally near the margin they are arranged in chevrons, and form eight marginal denticles The tentacles are often retracted, but generally remain exsert. The collaret is small.

The larger spicules of the coenenchyma and verrucae are rather small fusiform, often bent, irregularly covered with more or less numerous, prominent warts; some of these spicules are elongated and acute at both ends; others are stouter and more obtuse; the longer spicules may be as large as 0.42 by 0.06 mm.; the stouter ones, 0.21 by 0.06 mm. In the tentacles there are numerous slender, mostly bent, and sparingly warted or micro-spinulated spicules, acute at one end or both ends, with some that are larger, blunt, and roughly warted at one end, and others roughly warted all over; flattened oblong spicules, some of them with roughly warted border, also occur. The slender smooth spindles of the tentacles measure 0.23 by 0.02 mm.; the flattened oblong ones, 0.10 by 0.03 mm.

Type: — M.C.Z. cat. no. 4985.

Type locality: — Off Georgia, in 337 fms. ("Blake" Sta. 318).

Specimens examined: — The type, and six specimens from 324 fms. off Florida (M.C.Z. cat. no. 4986).

Remarks: — Possibly related to *Swiftia rosea* (Grieg) [*Leptogorgia irramosa* Molander, 1919]. It has the same crowded zooids and rod-like, warted spicules, but it seems to lack the short double stars (0.03–0.08 mm. long) and the color is also different. A large number of specimens may show that the two forms intergrade.

Pourtalès' *Gorgonia exserta,* from off Havana, 270 fms. is lost, but his material from off Florida, 324 fms. is still in the M.C.Z. It represents four small colonies with zooids much smaller and less crowded than in the type. The spicules are, however, of the same type, although less spinous, and I have therefore no doubt that these colonies represent the young stages of *S. casta.*

(Pourtalès, *Swiftia exserta,* came also from off Havana, 270 fms. It was a small colony and Pourtalès states that it resembles *Gorgonia exserta* but has irregular spicules and no spindles. The colony has not been found and it cannot be identified. Pourtalès must have overlooked, or forgotten, that *Gorgonia exserta* is a synonym of *Swiftia exserta.*)

2. Swiftia pourtalesii nom. nov.

Plate 18, fig. 4; Plate 20, figs. 6–10

Gorgonia miniata Pourtalès, 1868, p. 131. Non *G. miniata* Valenciennes, 1855, p. 12.
Non *Stenogorgia miniata,* Kükenthal, 1919, p. 642; 1924, p. 348.

Two specimens and a fragment are in the collection, all from the same locality. The larger one, the type, represents a colony about 6.5 cm. high and 7 cm. wide, much branched, with mostly upward curving branchlets. The main stem is broken about 1.5 cm. above the base. It is 2 mm. wide, and is entirely free of verrucae. It gives off two long branches with about eight-nine branchlets, some of these again giving off branchlets. The zooids are placed alternately in rows close together along the sides. The verrucae are low, conical, about 1 mm. wide and 0.5 mm. high, with eight-dentate opening and small anthocodia. One part of the colony has evidently been damaged as the verrucae here are more scattered or are totally absent. Normally the branchlets terminate bluntly, being about as wide at the tip as at the base (about 1 mm.).

The color of the colony is dull brick-red in alcohol, and deep pink when dry. The axis is brown, flexible, and horny; in the branchlets, pale yellow.

The spicules are pale rose in color. They consist chiefly of a dense layer of spindles, varying from slender to thick, and in most cases with at least one end pointed. They are covered with disk-shaped warts, not arranged in distinct belts and in various degrees of development. Short, more capstan-like bodies may also be present, with similar branched warts. The tentacles contain a great number of spindles, mostly curved, arranged in chevrons, and with scattered, simple warts, sometimes plate-like.

The average spindles are about 0.19 mm. in length; the capstans about 0.11 mm.; the rods in the tentacles may be as long as 0.25 mm.

Type: — M.C.Z. cat. no. 4987.

Type locality: — Off Florida, in 111 or 95 fms. ("Bache" Expedition Sta. 7 or 8).

Specimens examined: — Two complete specimens and one fragment.

Remarks: — Verrill saw the spicules from the Valenciennes type in Paris (see p. 180 above) and found that they were mostly double spindles, which seem to be absolutely lacking in this species. It consequently has nothing to do with the original *L. miniata*.

Neither does the present species seem to be identical with Kükenthal's *S. miniata* from Sombrero channel off the Nicobars in the Indian Ocean, as a glance at his figure will easily show.

3. Swiftia koreni (Wright & Studer)

Plate **18**, fig. 3; Plate **20**, figs. 11–17

Callistephanus koreni Wright & Studer, 1889, p. 149, pl. 29, figs. 2–2a; pl. 33, fig. 7.
Stenogorgia miniata Studer, 1901, p. 51, pl. 8, figs. 7–8. — Thomson, 1927, p. 52, pl. 1, figs. 10, 17–18; pl. 2, figs. 11–14, 21–23; pl. 3, fig. 7; pl. 5, fig. 21.
Non *Gorgonia miniata* Valenciennes, 1855, p. 12 (see p. 180).

The collection contains four specimens of a bright red species as much as 16 cm. in height. It is sparingly branched with long, upward bending branches and branchlets. The zooids are tall, the verrucae conical, with oval base and high crown of spicules in the tentacles, usually not retracted. The zooids are arranged in a scattered row along the side of the stem. The axis is pale yellow and glossy.

The spicules in the coenenchyma and verrucae consist of variously developed

spindles with complicated warts, and short thick bodies with plate-like warts. The tentacles contain large thick rods and plates with simple blunt warts, and smaller spinous rods.

The spindles may be as much as 0.30 mm. in length; the short warted bodies are about 0.10 mm., and the large rods in the tentacles about 0.30 mm.

Type: — Brit. Mus.

Type locality: — Off Ascension Island.

Distribution: — Eastern Atlantic Ocean around the Azores, etc.; West Indies; from 400–600 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4988	44	539	Off Florida (25° 33′ N., 84° 35′ W.)	1
4991	160	393	" Guadeloupe	fragment
4989	256	370	Off Grenada	1
4990	266	461	" "	1

Remarks: — It seems to me beyond doubt that the present form is identical with the bright red species which Wright & Studer describe from deep water off Ascension, and which was subsequently described by Studer and Thomson as *S. miniata* from the Azores and other localities in the eastern Atlantic. The specimen, however, which Pourtalès determined as *S. miniata* belongs to another species. Neither the species *koreni* nor the genus *Callistephanus* are included in Kükenthal's list of synonyms (1924). It seems to be fairly common in deeper water in the West Indian region.

Wright & Studer who established *Callistephanus* realized fully that their *C. koreni* resembled *Stenogorgia* and *Swiftia* but thought the spicules in their species were sufficient different to warrant a new genus "pending further knowledge."

4. Swiftia exserta (Ellis & Solander)

Plate 20, figs. 18–23; Plate 32, figs 1–1a

Gorgonia exserta Ellis & Solander, 1786, p. 87, pl. 15, fig. 1. — nec *G. excerta* Pourtalès, 1867 (=*S. carta* Verrill).

Swiftia exserta Duchassaing & Michelotti, 1864, p. 13, pl. 2, figs. 4–5.

Thesea gemmata Verrill, 1869, p. 428.

Not *Thesea exserta* Duchassaing & Michelotti, 1860, p. 18 (=*Thesea guadalupensis* Duchassaing & Michelotti, 1864).

The most complete colony is about 16 cm. high, exclusive of the base which is broken off, and about 7 cm. wide. It is a loosely branched form with one slender main stem, about 2 mm. wide near the base, and with a number of slender, upward turning branches which diverge at almost a right angle. The colony is soft and flexible and the branches are apt to curl together. The verrucae are large, conical in shape, and widely scattered along the edge of the stem and branches; two verrucae are usually present at about the same level.

The axis is horny brown, somewhat translucent, and colorless in the branchlets. The colony is pure white in alcohol.

The coenenchyma contains chiefly short blunt bodies with flat disk-shaped warts, and also some slender rods with widely separated warts. The latter kind dominates in the verrucae where they partly form longitudinal rows. The tentacles contain about seven to nine pairs of large, curved rods with numerous fine spines, arranged in double rows.

The short bodies measure about 0.1 mm. in length; the long rods, as much as 0.91 mm.; the rods in the tentacles, about 0.9–1.1 mm.

Type: — Possibly in England.

Type locality: — West Indies.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4980	127	38	Off Sta. Cruz	1
4981	155	88	" Montserrat	1
4982	156	88	" "	1
4983	203	96	" Martinique	1
4984	231	95	" St. Vincent	1

Remarks: — Verrill, 1869 d, p. 428, gave an exceptionally good description of "*Thesea gemmata*," from deep water of St. Croix and emphasized its similarity to *Gorgonia exserta* "as figured by Ellis & Solander, which Duchassaing & Michelotti refer to their *Swiftia exserta*, but it has more prominent verrucae" and he adds "its spicules are very different from those of *Thesea guadalupensis* and *Swiftia exserta*." The latter refers to the supposed lack of spicules in *S. exserta*. The type of *Thesea gemmata* is lost but the description agrees in all detail with the Blake specimens of *S. exserta*, and in Verrill's notes *Thesea gemmata* is referred to *Stenogorgia* (*Swiftia*).

Pourtalès, 1867, misunderstood the situation and reported both "*Gorgonia exserta*" and "*Swiftia exserta*" from off Havana, 270 fms. The former is a young colony of *Swiftia casta* (Verrill), the latter cannot be recognized at all. (See p. 188.)

5. Swiftia sp.

Plate 18, fig. 2; Plate 20, figs. 24–28

The collection contains one specimen, a short branch, the entire specimen being 80 mm. high. The branches are about 1 mm. wide, tapering toward the tip to about 0.75 mm. Verrucae conical, appressed, and rather soft; anthocodia long. Axis brown, horny; color of the colony pale pinkish in alcohol, almost white when dry. The spicules are poorly developed, possibly an abnormal condition. They consist of flat rods with dentate margin, and show dark lines radiating from the center and from the marginal teeth. No normal capstans are present, but there are short plates which seem to be degenerated capstans. The tentacles contain a great number (about 10–16) of flat, thin, dentate rods or plates, arranged in converging double rows.

The rods may be as large as 0.15 by 0.03 mm.; the deposits derived from capstans about 0.08 by 0.04 mm. The tentacles contain rods as much as 0.28 mm. in length and 0.03 mm. in width.

Locality: — Antilles. (Pourtalès Gulf Stream Explor., May, 1869.)

Specimens examined: — A fragment from off Pacific Reef, Florida, in 283 fms. M.C.Z. cat. no. 4992.

Remarks: — The closely appressed verrucae and the tall anthocodia, which form the larger part of the zooid, and the large number of tentacle rods, characterize this species. The spicules are undoubtedly abnormal. It may possibly be a variety of *S. exserta*.

Genus 4. Rhipidogorgia Valenciennes 1855

Diagnosis, from Kükenthal, 1924, p. 350: — Colony branched in one or in more parallel planes, fan-shaped, with extremely numerous anastomoses which form a narrow-meshed network. The zooids are placed laterally on the branches in close rows; verrucae, low. Their armature consists of small rod-shaped deposits, almost smooth. The coenenchyma contains an inner layer of double spindles, and an outer layer of scaphoids with warts arranged in rows. Color, violet or yellow.

Type species: — *Rhipidogorgia flabellum* (L.).

Distribution: — Shallow water form. Known only from the West Indies, including Bermuda.

Only one valid species, well represented in the collection.

Dubious forms: — *R. occatoria* and *coarctata* Val., 1855, p. 7, off Guadeloupe. *R. elegans* Duch. & Mich., 1864, p. 20, pl. 4, fig. 4, off Trinidad.

Remarks: — The genus, with its single species, has been treated in detail by Kükenthal, 1916, p. 485, text figs. O-Q. See also 1919, p. 775; 1924, p. 350.— Bielschowsky, 1818, pp. 50–52; 1929, p. 192.

1. Rhipidogorgia flabellum (Linnaeus)

Plate 21, figs. 25–28

For complete list of references see Kükenthal, 1924, p. 350; Bielschowsky, 1929, p. 192.

Diagnosis: — As for the genus.

Type: — Probably lost.

Distribution: — West Indies.

Depth: — From tidemark to probably 50 fms.

Specimens examined: — Several in the M.C.Z.

Genus 5. Pterogorgia Ehrenberg 1834

Diagnosis: — Mostly large colonies up to as much as 1 meter or more in height; branching chiefly in one plane with one or more main stems or main branches, and with a large number of branchlets arranged pinnately and occasionally giving rise to secondary branchlets. Stem and branches round or flattened; in the distal part, always flattened. Branchlets round or flattened. Zooids are usually completely retracted, forming slits or pores; in most cases placed in rows along the edge of the branchlets; in some forms also present on the stem. The zooids contain either no spicules, or a large number of small flattened rods arranged in eight triangles. The coenenchyma consists of an outer layer of half-moon shaped bodies (scaphoids) and warted rods, and an inner layer of rods alone. Color varying from reddish or greenish to yellow or white.

Type species: — *Pterogorgia acerosa* (Pallas). Restricted to the West Indian region; littoral, to about 35 fms. depth.

Remarks: — There are two small fragments in the "Blake" collection, representing two different species. It has been necessary to undertake a revision of the whole genus, based upon the old material in the M.C.Z. Brief descriptions and a key are given by Bielschowsky in Kükenthal (1919, pp. 853, 919; 1924,

pp. 351–355), and in her thesis (1918, p. 61). A detailed analysis is found in Bielschowsky, 1929, pp. 197–225, but it differs in many points from the account given here.

Key to the species of Pterogorgia from the West Indian waters

1. Scaphoids with warts on both the convex and concave side..... 1. *Pterogorgia bipinnata* Verrill.
1. Scaphoids with warts on the concave side only.....2.
2. Scaphoids short, blunt-ending; branchlets cylindrical, with zooids over the entire surface. 2. *P. americana* (Gmelin).
2. Scaphoids relatively long and with pointed ends; branchlets more or less flattened; zooids arranged in rows along edges of branchlets.....3.
3. Scaphoids long, with low warts in numerous rows which extend almost to the convex side. Branchlets short, rigid; colony branching in one plane..**3.** *P. sparsiramosa* Bielschowsky.
3. Scaphoids short to long, with few rows of warts, mostly confined to the concave side. Colony not always branching strictly in one plane.....4.
4. Scaphoids mostly strongly curved. Branchlets thick at base and tapering toward the tips. 4. *P. acerosa* (Pallas) *forma elastica* Bielschowsky.
4. Scaphoids mostly almost straight. Branchlets not remarkably thick at base and not tapering toward the tips.....
5. Branchlets crowded, not always in one plane..... 4. *P. acerosa* (Pallas) *formae typica* and *arbuscula* Bielschowsky.
5. Branchlets distant, in one plane.....5. *P. ellisiana* Milne-Edwards.

Remarks: — The key and the descriptions below differ from Bielschowsky's conclusions in the following: —

1. *P. kallos* and *P. antillarum* have been placed as synonyms of *P. bipinnata* Verrill.
2. Her *P. bipinnata* (and var. *sparsiramosa*) is not Verrill's species, but seems to be so different from the *acerosa* group that it has to be regarded as a separate species. It is here called *P. sparsiramosa* Bielschowsky.
3. Her *P. acerosa* var. *rigida* seems to be identical with what hitherto has been regarded as *P. americana* (Gmelin.). It was designated as such and well redescribed by Verrill about seventy years ago.
4. Her *P. acerosa* forms *typica* and *arbuscula* seem to be merely different stages in age of the same species, and have therefore been united under *P. acerosa*.
5. *P. ellisiana* Milne-Edwards has been re-established on the basis of a fragment sent to Prof. Verrill from Kölliker, presumably from the type, the description given by Milne-Edwards, and the examination of numerous specimens in the M.C.Z. collection.

1. Pterogorgia bipinnata Verrill

Plate 21, figs. 1–16

Pterogorgia bipinnata Verrill, 1864, p. 31.

P. gracilis Verrill, 1868, p. 359, pl. 4, figs. 2 a–b, 3; 1869, p. 424. — Bielschowsky, 1929, p. 222 (*partim*).

P. kallos Bielschowsky, 1918, p. 62 (*nomen nudum*); 1919, in Kükenthal's monograph, p. 919; 1929, p. 217, pl. 4, fig. 22, text-fig. 39.

P. antillarum Bielschowsky, 1918, p. 62 (*nomen nudum*); 1919, in Kükenthal's monograph, p. 919; 1929, p. 215, pl. 5, fig. 25, text-fig. 38.

Non *P. bipinnata* Bielschowsky, 1929, p. 213, pl. 4, fig. 21,

Non *P. bipinnata* var. *sparsiramosa* Bielschowsky, 1919, (in Kükenthal's monograph), p. 919; 1929, p. 215, pl. 5, fig. 26, text-fig. 37.

The type represents a fragment of a well developed colony with flattened stem and with several lateral branches, all flattened and all in the same plane. The stem and branches carry short rigid branchlets which are well spaced. The zooids are arranged in zigzag rows along the branches and branchlets. The color of the type is pale violet when dry; the axis is brown and horny; other specimens may be bright yellow.

The outer layer of the spicules in the coenenchyma consists of scaphoids which have two-four rows of conical projections on the convex side and a number of warts in bundles on the concave side; in the inner layer are the usual pointed warted rods. The zooids contain a few flat rods in the operculum.

The scaphoids and spindles are 0.16–0.18 mm. in length; the flat rods in the zooids, about 0.09 mm. long.

There are two other specimens which are so imperfect in their condition that nothing can be said about their outer shape. The color is pale violet in one case and dirty yellow in the other. The spicules resemble those of the type, but are slightly smaller, and often have only two projections on the convex side.

Type: — M.C.Z. cat. no. 5080.

Type locality: — Cumaná, Venezuela; in shallow water.

Distribution: — The species is known from the type locality, from the waters off Barbados and Florida, and also from Abrolhoes Reef, Brazil.

Specimens examined: — The type; a fragment from 13 fms., off Barbados ("Blake" Sta. 285), and a fragment collected off Marquesas, Fla. (Pourtalès Gulf Stream Explor. M.C.Z. cat. nos. 5081–5082). Also, a fragment of the type of *P. gracilis* (loaned from Yale), from Abrolhoes Reef, Brazil (Yale Museum).

Remarks: — The specimens examined agree so well with the description of Bielschowsky's two species that their identity seems certain. Her species *P. antillarum* seems to be nearest to the whitish specimen from Barbados, and her *P. kallos* nearest to the violet specimens from Venezuela and Marquesas, Florida.

2. Pterogorgia americana (Gmelin)

Plate 21, figs. 29–32

Pterogorgia americana (Gmelin), see Verrill, 1863, p. 31 (with list of synonyms); 1907, p. 300.
P. turgida Ehrberg, 1834, p. 370, see Kükenthal, 1919, p. 776 (as doubtful form); 1924, p. 355.
P. acerosa (Pallas) var. *rigida* Bielschowsky, 1929, p. 212.

Verrill's description: — "The *Gorgonia americana* of Gmelin was based upon the figure of Ellis & Solander (pl. 14, fig. 3) which is a good representation of the species when preserved in alcohol with the polyps expanded. The polyps are much larger than in the two preceding species [*setosa* Ehrb. and *acerosa* (Pallas)], and are arranged somewhat irregularly, in two or three rows, on each side of the large and nearly cylindrical branchlets. — Florida, L. Agassiz."

The M.C.Z. possesses one specimen, found among several specimens from Florida, which has large zooid apertures in irregular rows on the thick, cylindrical branchlets. I have no doubt that it is identical with Verrill's specimen. It is an irregularly twisted form with closely set branchlets, 3 mm. in diameter (1.5-2 mm. in *P. acerosa*). The stem carries a large number of zooids in irregular broad rows; on the branchlets they are in irregular rows on each side, sometimes almost covering the whole branchlet. In the present dry specimen they are completely retracted and visible as dark pits. The color is dirty yellow.

The spicules are decidedly different from those of the typical *P. acerosa*. The scaphoids are short, almost blunt, with two rows of warts on the concave side and smaller clusters of warts near the ends. There are also girdled spindles with two rows of warts and a cluster of warts at the ends. The inner layer contains slender rods, with the warts and girdles better separated. There are no spicules in the zooids. Scaphoids, about 0.08 mm. in length; inner rods, 0.1 mm. long.

Type: — Most likely lost.

Type locality: — West Indies.

Distribution: — Off Florida. Also from Bermuda. Verrill's description (1907) is very convincing.

Specimens examined: — One colony (M.C.Z. cat. no. 5070), and a branch (4129), both from Florida, L. Agassiz Coll.

Remarks: — Bielschowsky's *P. acerosa* var. *rigida* seems to be identical with this species. As it has entirely different spicules from those in the other forms of that group, I think it more correct to use the name *P. americana*, especially since that name has been used by Verrill (1863), accompanied by a description which is so clear that one cannot mistake the species for any other.

3. Pterogorgia sparsiramosa Bielschowsky

Pterogorgia bipinnata Bielschowsky, 1929, p. 213, pl. 4, fig. 21.
P. bipinnata var. *sparsiramosa* Bielschowsky, 1929, p. 215, pl. 5, fig. 36, text-fig. 37.
? *P. luteseens* Duchassaing & Michelotti, 1860, p. 30. — Bielschowsky, 1929, p. 223.

In the M.C.Z. are two branches of a *Pterogorgia* of very striking outer shape. They resemble exactly Bielschowsky's figure of var. *sparsiramosa* and also, somewhat, the type of *P. bipinnata* Verrill.

The branches are flattened, and give off short rigid flat branchlets, at the most 5 cm. in length, well-spaced, and all in the same plane. The zooids are arranged in a zigzag row along the edge of the branches and the branchlets and, contrary to what is usually the case, they often form indistinct verrucae.

The color of the colony is bright yellow in alcohol, and is incorporated in the spicules. The axis is brown and horny.

The spicules consist of large, almost straight scaphoids with a large number of transverse rows of warts which often extend almost to the convex side, but never form regular conical projections. Intermingled with this kind of deposits are numerous belted rods. As Bielschowsky correctly points out there is no distinct outer and inner layer of spicules of different kinds. The zooids contain a few flat lobate rods which form a small operculum.

The spicules in the coenenchyma are as much as 0.18 mm. in length; the opercular rods, 0.1 mm. long.

Type: — In Hamburg Museum; received from the M.C.Z.

Type locality: — Lesser Antilles (Barbados).

Distribution: — With certainty known from Barbados only.

Specimens examined: — Two fragments, labelled West Indies, received from New Orleans; possibly the same lot from which Bielschowsky received her material, (in the old catalogue tentatively designated as *P. bipinnata* Verrill MS). M.C.Z. cat. nos. 5083–5084.

Remarks: — The circumstance that Bielschowsky received her material from Harvard makes it absolutely certain that the identification is correct. Although the present species resembles *P. bipinnata* from Venezuela, the spicules are so different that the two cannot be united until it can be proved that there is a gradual variation from the spicules of one form to those of the other. The shape of the colony, together with the presence of rods in the operculum, seems to prove that *bipinnata* and *sparsiramosa* are related, but it does not necessarily mean that they are identical.

It is possible that examination of Duchassaing & Michelotti's type of *P. lutescens* from the Antilles will prove that the present species is the same. The yellow color together with the statement "zooids not retractile" indicate such a possibility.

4. Pterogorgia acerosa (Pallas)

Plate 21, figs. 17–20

Pterogorgia acerosa Bielschowsky, 1929, p. 205 (complete list of references and description).
P. acerosa formae *typica* and *arbuscula* Bielschowsky, 1929, p. 209, pl. 4, figs. 19–20, text-figs. 32–33.

In the M.C.Z. are several colonies of this tall gorgonian which resembles a gigantic ostrich feather. The colony is more than one meter in height and usually has more than one stem, with or without strong branches, and a large number of crowded long branchlets which rarely are placed in one plane. The colonies may be erect or drooping. The zooids are often present on the rounded stems or parts of the stems and branches in an irregular fashion. On the flattened branchlets they are placed in zigzag rows along the edges.

The color of the colony varies from whitish to deep purple. The spicules in the inner layer are always deep red, while those in the outer layer may be colorless, or red. The axis is brownish, more or less woodlike or stonelike in the basal part, and more horny in the branchlets.

The spicules in the outer layer of the coenenchyma consist of slender scaphoids with two pairs of warts on the concave side and some irregularly placed bundles of warts near the pointed ends. The inner layer consists of short and blunt, or long and pointed, warted rods. The zooids have no flattened rods in the base of the tentacles.

The spicules may be as much as 0.15 mm. in length.

Type: — Very likely not preserved.

Type locality: — "Mare americanum."

Distribution: — West Indian waters, and Bermuda. The record from the Mediterranean Sea is undoubtedly a case of erroneous labelling, a common occurrence in older collections.

Specimens examined: — Twenty colonies from various localities in Florida and from Hayti (M.C.Z. cat. nos. 5085–5090).

Remarks: — The material examined shows so great a variation in size of colonies, length of branchlets, number of stems, color, arrangement of zooids

on the stem, and spicules, that it seems impossible to distinguish definite forms. *P. acerosa* forma *arbuscula* seems to be merely an old age stage of the typical form.

4a. Pterogorgia acerosa (Pallas) var. elastica Bielschowsky

Pterogorgia acerosa var. *elastica* Bielschowsky, 1929, p. 210, pl. 5, fig. 23, text-fig. 35.

The M.C.Z. collections contain one colony which agrees closely with Bielschowsky's description. It is low (35–40 cm. in height) and has an enormous broad base from which several stems arise, crowded with branchlets. The latter are notably thick at the lower end and taper toward the tip. The zooids are arranged in double to zigzag rows along the edges of the slightly flattened, almost round branchlets.

The spicules agree, both in arrangement and size, with those found in the typical *P. acerosa*, except for the fact that most of the scaphoids belong to the small, strongly curved type. No opercular rods are present.

Type: — Museum of Hamburg.

Type locality: — Kingston, Jamaica.

Distribution: — From Florida and the Antilles.

Specimens examined: — One colony from Hayti; no definite locality (M.C.Z. cat. no. 5008).

Remarks: — This variety may be a dwarfed form of *P. acerosa*, possibly due to the influence of poor living conditions. The colony examined gives the impression of being abnormal.

5. Pterogorgia ellisiana H. Milne-Edwards

Plate 21, figs. 21–24

Pterogorgia ellisiana H. Milne-Edwards, 1857, p. 169.
Leptogorgia solitaria Hargitt & Rogers, 1901, p. 285, fig. K 2–5.

The original description reads as follows: — "Branches très écartées entre elles. — Tige subcylindrique, portant de chaque côté une série de branches simples et ascendentes, qui sont très écartées entre elles, comprimées et marquées d'un sillon très profond. Calices disposés sur chaque bord en deux rangées laterales très serrées, qui alternent et se confondent souvent en une seule série. Couleur brun-jaunâtre. Guadeloupe."

The colonies grow to a height of more than one meter. They have one or more stems arising from the base, and sometimes also secondary stems. The

branchlets may be separated by a distance of several cm., and are long (10–20 cm.) slender, and flattened, while the stem is round. The lateral solenia are often distinguishable on the surface as a furrow. The zooids are arranged along the edges of the branchlets, and frequently also on the stem, in a zigzag to single row.

The color of the colony in all observed cases is brownish, often with a violet tinge. The spicules in the outer layer are colorless; those in the inner layer are violet.

The spicules resemble closely those found in *P. acerosa*, in size as well as in shape.

Type: — Paris Museum.

Type locality: — Guadeloupe.

Distribution: — Off the Lesser Antilles and Florida.

Specimens examined: — A fragment (5091) sent by Kölliker to Verrill, probably from the type; and ten complete specimens, all from Florida and Cuba (M.C.Z. cat. nos. 5071–5079).

Remarks: — Milne-Edwards' description, together with the fragment sent by Kölliker, makes the determination certain. It seems to be a fairly common form. Although the spicules resemble those found in *P. acerosa*, it appears to be quite distinct. None of the colonies show any gradation toward *P. acerosa*.

Hargitt & Rogers *Leptogorgia solitaria* (U S. N. M. 42606) has been examined. It is a branchlet from *P. ellisiana*.

Genus 6. Xiphigorgia H. Milne-Edwards 1857

Diagnosis, from Kükenthal, 1919, p. 854:—Branching of colony variable. The zooids are placed in longitudinal furrows along the edge of the branches which are strongly flattened, or triangular to squarish in cross section; zooids very small, and armed with flat rods in eight bands. The coenenchyma contains thick, strongly, but not very regularly, warted spindles, and also scaphoids which are entirely without warts on the convex side. Color, violet or yellow.

Shallow water forms; restricted to the Antillean region. Two valid species are known: *X. anceps* (Pallas) and *citrina* (Esper); one uncertain, *setacea* Kükenthal. See Kükenthal, 1919, p. 779).

Type species: — *Xiphigorgia anceps* (Pallas).

Remarks: — All three forms are treated by Kükenthal (1916, pp. 493, 498, 502; 1924, p. 357). The dubious third species was collected off Honduras, and seems to be a *Leptogorgia* (see p. 179) as Bielschowsky (1929, p. 255) also thinks.

The two valid species appear to be fairly common, and are well represented in the M.C.Z.

Key to the species of Xiphigorgia

Large form with branches triangular to squarish in cross section.1. *Xiphigorgia anceps* (Pallas).
Small form with flat branches.....2. *Xiphigorgia citrina* (Esper).

1. Xiphigorgia anceps (Pallas)

For complete list of references, see Kükenthal, 1916, p. 493, pl. 23, fig. 4, text-figs. U-V; 1924, p. 357. — Bielschowsky, 1929, p. 225.

The species is tall, up to about 50 cm. with few long upward bent branches usually triangular or quadrangular in cross section; the terminal part is however, often flattened. The color is yellow to purple.

Type: — Probably lost.

Type locality: — "Mare americanum."

Distribution: — Common in the waters around Cuba and Florida, in shallow water, but exact distribution is not known.

Specimens examined: — Several in the M.C.Z., cat. nos. 5056–5060.

2. Xiphigorgia citrina (Esper)

For complete list of references, see Kükenthal, 1916, p. 498, pl. 23, fig. 5, text-figs. W-V; 1924, p. 358. — Bielschowsky, 1929, p. 226.

The species is small, fan-shaped, about 15 cm. high, with numerous flat branches which form short branchlets, dichotomously. Color, bright yellow with small violet zooids; sometimes the purplish color spreads to larger parts of the coenenchyma.

Type: — Probably lost.

Type locality: — "Nova Hispanica."

Distribution: — Similar to that of *X. anceps;* also known from Bermuda.

Specimens examined: — Several in the M.C.Z., cat. nos. 3976, 5051, 5054.

Genus 7. Phyllogorgia M. Milne-Edwards 1850

For list of synonyms see Kükenthal, 1924, p. 358, and Bielschowsky, 1929, p. 227 (under Hymenogorgia.)

Diagnosis: — Colonies branching in one plane; branches forming strongly flattened leaves, often fused. The zooids are small and placed on the entire surface of the leaves. Spicules as spindles and scaphoids.

Type species: — *Phyllogorgia dilatata* (Esper).

Only one species is known.

Phyllogorgia dilatata (Esper)

For literature, synonyms, etc., see Kükenthal, 1924, p. 359, and Bielschowsky, 1929, p. 227.

Diagnosis: — As for genus.

Type: — Probably lost.

Type locality: — "Wahrscheinlich das Meer des südlichen America."

Distribution: — Off the coast of Brazil, also reported from off Guadeloupe, W. I. Shallow water.

Specimens examined: — Several in the M.C.Z. cat. nos. 4925, 5094–5096.

Remarks: — Bielschowsky lists *P. quercifolium* (Esper) as a separate species, but the material in the M.C.Z. shows clearly that the latter form intergrades with the typical form and cannot be kept separate.

Family 10. GORGONELLIDAE

Plate 24

Diagnosis, from Toeplitz, in Kükenthal, 1919, p. 856: — Colonies unbranched, bushy, or branching in one plane. Zooids on all sides, or biserial, or in several lateral rows leaving a narrow strip free on the front and back sides. Verrucae always distinctly developed; operculum always lacking. The armature of the zooids characterizes the different genera. Spicules as double-heads, double-clubs, double-spindles, or double-rods; also as flattened capstans. Canal system consisting of a cylinder of longitudinal canals arranged around the axis. Among these two, three, or four, situated beneath the zooid-free area, may be characterized by a wider lumen. Axis consisting of concentrically arranged lamellae of calcified horny substance, between which calcareous lamellae may be intercalated.

Remarks: — Indo-Pacific and Atlantic in the tropical zone; littoral or coast abyss. The family is briefly treated by Kükenthal (1924, p. 360), and six certain genera, with forty-five certain and ten dubious species, are listed by him. A complete revision of the family was published by Toeplitz (1929). Only three genera have been reported with certainty from the West Indies, namely *Scirpearia*, *Nicella*, and *Juncella*. The occurrence of a fourth genus, *Ellisella*, is

wrong. The only species recorded, *E. elongata* (Pallas), is, if my determination is correct, a *Scirpearia*. The record of the Indo-Pacific *Junceella juncea* (Pallas), made by Duchassaing & Michelotti, is undoubtedly a mistake; most likely they had *Scirpearia elongata* before them (see p. 212). For other genera, see Kükenthal, 1924, p. 360.

List of species known from the West Indies

Valid species: —

Junceella antillarum Toeplitz

Scirpearia atlantica Toeplitz, 1929

S. barbadensis (D. &. M.), (*S. rigida* Toeplitz, 1929, including a variety, var. *tenuis* Toeplitz; nec *barbadensis* Studer)

S. grandis Verrill

S. grandiflora sp. nov.

S. funiculina (D. & M.)

S. elongata (Pallas)—(*Elisella elongata* of Toeplitz (*reference only*), and, as far as I can determine, also *S. cylindrica* Toeplitz)

Nicella americana Toeplitz

N. guadalupensis (Duch. & Mich.)

N. ramosa Toeplitz

Doubtful species: —

From Brazil.

Junceella hystrix Valenciennes

From the eastern part of the Atlantic Ocean.

S. flagellum (Johnson)

N. granifera (Kölliker)

N. multiramosa Kükenthal

Toeplitz, 1929, refers Simpson's material of *S. flagellum*, from off South Africa to her new species *S. atlantica* and *S. rigida*, from the West Indies, but most likely she is wrong. She had no material from South Africa before her, but based her conclusions upon study of Simpson's figures.

Key to the genera of Gorgonellidae

Kükenthal, 1919, p. 857.

1. Colonies unbranched, or loosely, sparingly branched; terminal branches long, whip-like..2.
1. Colonies branched several times, in one plane; terminal branches short.....4.
2. Branches arising from one side of the main stem and equally long, giving a comb-like effect.....*Ctenella.*

2. Branches not arising from one side only; most forms unbranched, whip-like.....3.
3. The verrucae contain large double spindles or simple spindles, whereas the thin coenenchyma contains chiefly double spheres.....2. *Scirpearia.*
3. Verrucae with spicules similar to those of the coenenchyma.....4.
4. The outer layer contains asymmetrical double clubs.....1. *Junceella.*
4. The outer layer contains symmetrical double spheres.....*Toeplitzella* (*Ellisella*).
5. The inner layer contains spindles and double spindles at least twice as long as the double spheres in the outer layer ..... 3. *Nicella.*
5. The spindles and double spheres are of about the same length.....*Gorgonella.*

1. Junceella Valenciennes 1855

Diagnosis, from Kükenthal, 1919, p. 857: — Unbranched, or branched mostly in one plane and then dichotomously. Zooids on all sides, or in bands anteriorly and posteriorly with a naked longitudinal stripe. Verrucae directed obliquely upward. The retractile zooids contain slender, irregularly warted, small rods arranged in eight longitudinal rows, and similar spicules are present in the tentacles. The outer layer of the coenenchyma contains small asymmetrical clubs; beneath these, symmetrical spicules may also be present. In addition to horny lamellae which are calcified, the axis contains calcareous lamellae, apparent in cross-section.

Type species: — *Junceella juncea* (Pallas).

Remarks: — Kükenthal lists seven valid and seven dubious species. Only one of these is at present known from the West Indian region; the others are Pacific forms.

J. juncea is mentioned by Duchassaing & Michelotti from Guadeloupe. Probably it was *Scirpearia elongata* (Pallas) which resembles it considerably.

Three other species have been described by Duchassaing & Michelotti as *Junceella.* Two of these have been transferred to *Scirpearia;* the third cannot be identified but is probably a *Thesea. J. hystrix* Valenciennes, 1855, p. 14, from off Bahia cannot be identified. It is probably a *Scirpearia.*

1. Junceella antillarum Toeplitz

Juncella barbadensis Wright & Studer, 1889, p. 159, pl. 34, fig. 14; nec *J. barbadensis* Duchassaing & Michelotti, 1964, p. 22, pl. 5, figs. 5–6; nec *J. barbadensis* Stimpson, 1910, p. 305.
Juncella antillarum Toeplitz, 1919, (in Kükenthal, p. 922); 1929, p. 267.

From Wright & Studer's description one learns that their fragments were about 15 cm. long, unbranched, with rather tall zooids, 2.5 mm. high, and placed in four longitudinal rows. The spicules figured resemble those of a typical

Junceella juncea; the clubshaped bodies measure 0.1–0–0.4 mm.; the double stars 0.06–0.1 mm. the spindles 0.1–0.25 mm.

Type: — Br. M.

Type locality: — Off Sombrero Island, W. I.

Distribution: — Known only from the type locality.

Depth: — From 450 fms.

Specimens examined: — None.

Remarks: — The species has never been found again and one is tempted to think that there is some mistake in the labelling as other species in this genus are usually taken at much lower depth. *Junceella juncea,* for example, is said to occur from tidemark to about 40 fms. depth.

Duchassaing & Michelotti's *J. barbadensis* is considered a *Scirpearia.* Their *J. juncea* (which Toeplitz places as a synonym of *J. antillarum* with a ?) is undoubtedly *S. elongata* (Pallas), see p. 214.

Toeplitzella nov. nom.

Syn. — *Ellisella* (partim) Toeplitz, nec Gray.

Diagnosis: — See Toeplitz, 1929, p. 273, for *Ellisella.*

Type species: — *T. laevis* (Verrill).

Remarks: — The new genus is established to receive the five species which Toeplitz (and Kükenthal) refer to *Ellisella* with *E. elongata* (Pallas) as the type species. As the latter now is placed in *Scirpearia* a new name must be given.

Ellisella was established by Gray in 1857 for *E. elongata, juncea* and *pectinata,* all described by Pallas. In 1870 Gray placed the two last mentioned species in other genera, and reserved *Ellisella* for *elongata* alone (including *coccinea*). Simpson, 1910 had occasion to examine a colony of Pallas' species and referred it to *Scirpearia.* Later Toeplitz (1919, in Kükenthal's monograph, and in 1929) re-established *Ellisella* and gave a complete exhaustive discussion of the question and its history. She had, however, no material of *elongata,* and her conclusions regarding the type species were based upon Simpson's work. In the same papers she also described a new species of *Scirpearia,* from the West Indies, a species which undoubtedly is identical with *elongata* (Pallas). It is possible that *Toeplitzella* in the end will become a synonym of *Scirpearia,* but from the figures which Toeplitz gives of four of the five Indo-Pacific species hitherto referred to *Ellisella,* it looks as if they actually lack the larger spindles which constitute one of the most characteristic features in *Scirpearia.*

Genus 2. *Scirpearia* Cuvier 1817

Diagnosis, from Kükenthal, 1919, p. 859: — The colony is unbranched or sparingly branched, with long, whip-like, terminal branches. The zooids are arranged in lateral rows or in spirals. The tentacles contain warted double spindles; the zooid wall, warted rods. The verrucae spindles and double spindles are about 0.07 to 0.2 mm. long. The coenenchyma is filled with double spheres.

Type species: — *Scirpearia flagellum* (Johnson).

Remarks: — Kükenthal (1924, p. 368) lists seventeen species which he considers valid, and two varieties; besides, two dubious species.

Six species from the West Indian waters are described in the following pages. One appears to be new.

Key to the species of Scirpearia from the West Indian Waters

1. Double heads mostly with numerous warts of about equal size, crowded together....2.
1. Double heads mostly with relatively few warts of unequal size and often separated into an inner belt and a terminal tuft.....3.
2. Zooid spicules pointed, mostly double cones, and distinctly larger than the double heads.. 1. *S. atlantica* Toeplitz.
2. Zooid spicules more or less blunt, and not much larger than the double heads..... 2. *S. barbadensis* (Duchassaing & Michelotti).
3. Stout rods in zooids, with few large warts.....4.
3. More delicately pointed, narrow to elliptical rods in zooids, with large number of small warts..... 5.
4. Zooids small, even in large specimens. Double heads numerous. Color, pure white..... 3. *S. funiculina* (Duchassaing & Michelotti).
4. Zooids large. Double heads scarce; short cylindrical rods with large warts dominating. Color, grey stem and yellow zooids.....4. *S. grandiflora* spec. nov.
5. Zooid rods mostly slender. Zooids cylindrical, bent upward, often scale-like..... 5. *S. elongata* (Pallas).
5. Zooid rods mostly thick, elliptical. Zooids contracted into low warts..... 6. *S. grandis* (Verrill).

1. Scirpearia atlantica Toeplitz

Plate **24**, figs. 20–28a

Scirpearia atlantica Toeplitz, 1929, p. 302, pl. 7, fig. 6, text-fig. 13. Kükenthal, 1924, p. 370.
Scirpearia ochracea Toeplitz, 1929, p. 296, text-fig. 10. Nec *S. ochracea* Studer 1891, p. 559; 1901, p. 53.

The M.C.Z. collection contains a large number of colonies of different size. I have found aberrant spicules in a few colonies, the shape of which may be

due to poor development and I have therefore not placed these specimens in separate varieties.

The smallest specimen is about 15 mm. high with a stem 0.5 mm. wide; the largest, about 1 meter high with a diameter of 4.5 mm. near the tip. The zooids are arranged either in a single row, scattered or close, or in a zig-zag to double row. The portion of the stem nearest the base is free from zooids. The zooids are at the most 3 mm. in length and 0.7–1.5 mm. in breadth. They are either contracted into low warts, or cylindrical and bent upward. Two of the longitudinal canals are larger than the remaining ones. The axis is calcified as usual. The color of the colony is orange with yellow to white zooids.

The spicules in the outer layer of the coenenchyma are chiefly well developed double heads of varying size, with numerous warts of about the same size, and double rods with fewer warts. The inner layer contains flat capstans. The spicules in the zooids are in most cases long, pointed, double cones with narrow middle, and the tentacles carry similar though smaller spicules. In the basal portion of the zooids there are short, angulated rods. In a few colonies the zooid rods have small warts, and sometimes the rods are much smaller than normal, thus approaching those in *S. ochracea* Toeplitz.

The double heads may be as much as 0.06 mm. in length; the double-rods, 0.08 mm.; the capstans are also about 0.08 mm. The typical zooid spindles may be as long as 0.17 mm.; the abnormal small ones, 0.10 mm. The tentacles rods average 0.07–0.09 mm.

Type: — Museum of Munich.

Type locality: — Off Barbados, in 183 fms. ("Hassler" Exped.).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4712	132	117	Off St. Croix	2 small
4713	203	96	" Martinique	1 large, 1 small
4714	231	95	" St. Vincent	1 large, 1 small
4715	232	88	" " "	1 small
4716	272	76	" Barbados	numerous,young
4717	276	94	" "	fragments
4718	278	69	" "	4 small
4719	292	56	" "	2 small
4753	17 Bartlett, 1880.	41	" Honduras	1 large

Remarks: — I have united Toeplitz's *atlantica* and *S. "ochracea."* The character "low, vertically directed calicles" is not reliable, as the same colony may

contain some zooids which are bent upward, and others which are vertical to the stem and contracted to low warts. Spicules which closely resemble those figured by Toeplitz for *S. ochracea* are present in some of the colonies, but there is a gradual increase in size almost to that of the spicules in the typical colonies. The "*ochracea*" colonies in the collection completely resemble the "*atlantica*" colonies and occur in the same hauls. Toeplitz describes *S. atlantica* as being orange with white tipped zooids, and *S. ochracea* as being orange with yellow tips, but this is not a sufficient distinguishing character, as there are all gradations in coloration.

It is another question whether Toeplitz's *atlantica—ochracea* is identical with Studer's *S. ochracea* from the eastern part of the Atlantic Ocean. His figures of the colony resemble somewhat a young *S. atlantica*, but his figures of the spicules, which are rather poor, show no similarity either to the large spicules in the zooids of the typical "*atlantica*" form or to the more fragile slender rods in Toeplitz' "*ochracea*." Most likely his *S. ochracea* is the young of *S. flagellum* (Johnson), as Simpson is inclined to think (1910, p. 328).

Toeplitz also lists *S. atlantica* from the waters off Cape of Good Hope, but she had no material for comparison. Simpson (1910) maintains that the species in question is *S. flagellum* (Johnson) and, as far as I can see from a study of his paper, he is right.

2. Scirpearia barbadensis (Duchassaing & Michelotti)

Plate **24**, figs 1–19

Juncella barbadensis Duchassaing & Michelotti, 1864, p. 22, pl. 5, figs. 5–6. — Nec *J. barbadensis* Studer, 1889, p. 159, pl. 34, fig. 14.

Scirpearia rigida (partim) Toeplitz, 1919, (in Kükenthal's monograph); 1929, pl. 6, fig. 5, text fig. 11.

Scirpearia rigida var. *tenuis* Toeplitz, 1919, p. 923 (in Kükenthal's monograph); 1929, p. 299, pl. 6, fig. 5a, text-fig. 12.

The M.C.Z. collection contains a large number of specimens, of extremely variable exterior but with a fairly uniform type of spicules, which I have referred to Toeplitz' *S. rigida*. The variety is based upon the additional presence of long slender rods in the coenenchyma. I think, however, that it is an uncertain difference, and difficult to confirm absolutely.

The colonies are mostly fragments, and vary considerably in thickness, color, and in distribution and size of the zooids. The most delicate specimen, a fragment which is possibly the tip of a large specimen, has a stem 1 mm. wide,

and zooids 1 mm. high and 0.5 mm. wide, arranged closely in a row along the side, smaller and larger zooids alternating. The largest fragments have a diameter of 4 mm., and strongly contracted zooids which measure 1 mm. in height (much more when expanded) and 1 mm. across, and are arranged in a scattered double row. Beside these, there are fragments with zooids in zig-zag to single rows, partly contracted and 2 mm. in height, and a few fragments where three scattered rows are present. A few fragments show that the colonies sometimes are bifurcated. Two (or three) longitudinal canals are larger than the others. The axis is calcified, with concentrically arranged lamellae.

The color of the colony varies from pure white to orange; the axis is greyish.

There is also in this species some variation in the size of the spicules. The spicules in the outer layer of the coenenchyma are double heads, with warts of almost uniform size. In most cases these bodies are large and robust, but sometimes they are small with a thin, delicate stem. In the inner layer are flat, warted capstans. The zooids contain short thick double rods with chiefly confluent warts. Similar though smaller rods are present in the tentacles. In the basal portion of the zooids there are angulated rods.

The double heads are 0.05–0.07 mm. in length in the colonies with large spicules; the capstans as much as 0.09 mm.; the zooid rods 0.11–0.13 mm.; the tentacle rods 0.09 mm. In the colonies with smaller spicules, the double heads are between 0.045–0.060 mm.; the zooid spicules 0.09 mm., etc.

Type: — Museum in Turin.

Type locality: — Off Barbados.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4720	132	115	Off St. Croix	fragments
4721	134	248	" " "	2 fragments
4722	249	262	" Grenada	2 large
4723	253	92	" "	2 large (small spicules)
4724	276	94	" Barbados	fragments
4725	297	123	" "	2 large

4726 "Hassler" Exped., off Barbados, in 100 fms., 1 young (or tip of large specimen)

4727 Sigsbee, coll., off Havana in 175 fms., fragment

4754 No locality; several fragments.

Remarks: — It is possible that the present material represents several varieties, but I have not been able to define the differences.

The important feature seems to me to be the relatively small difference in size between the larger double heads and the blunt rods in the zooids, a feature which holds for all of the colonies. Other features, such as the arrangement of zooids, branching and not branching, may be of importance, but the material is too meagre to make a decision possible.

I am strongly inclined to think that this form, with its mostly stout zooids, is identical with Duchassaing & Michelotti's *Junceella barbadensis*. There is one colony (from Sta. 253) which exactly resembles their figures, and is also pure white.

Toeplitz also states that this species occurs off South Africa. However, she has not examined any colonies from that region but bases her opinion upon the study of some of the figures given by Simpson, 1910, figs. 51–54 of *S. flagellum*. His identification is probably correct.

3. Scirpearia funiculina (Duchassaing & Michelotti)

Plate **24**, figs. 29–36

Juncella funiculina Duchassaing & Michelotti, 1864, p. 22, pl. 5, figs. 7–8. — Kükenthal, 1924, p. 364. — Toeplitz, 1929, p. 272.

The collection contains a few, almost complete specimens of striking outer form. The smaller specimens measure 36 cm. in length; the diameter of the stem ranges from 0.7 mm. in the lower part to 0.5 mm. in the upper part. The largest specimen is more than 1 meter high, excluding the base, and has a diameter of 3 mm. in the lower part and 1.5 mm. in the upper part (the top is missing).

The zooids are small, narrow, cylindrical, about 1 mm. in length and 0.5 mm. in diameter, in both the small and large specimens. They are bent upward, or appressed; in the large specimens they are partly retracted and form circular pits. They are arranged in a crowded zig-zag to single row on each side. The axis is formed of concentric layers and is flexible in the small specimens, rigid in the large ones; the longitudinal canals are of unequal size, two being larger than the others.

The color of the colony is pure white (in alcohol); the axis, greyish.

The spicules in the coenenchyma consist of an outer layer of double heads, mostly with much larger warts in the inner belt than toward the ends; or they may be in the form of elongate rods with well separated belts of large warts and a small cluster of terminal warts. The inner layer consists of flat, warted cap-

stans. The zooids contain elongated rods with large warts in irregular belts, smooth toward the middle. In the tentacles are shorter rods of similar form.

The double heads measure about 0.06 mm.; the double rods, 0.08 mm.

Type: — Possibly in Turin.

Type locality: — Off Guadeloupe.

Distribution: — Apparently quite common in the West Indies.

Depth: — From 45 to 263 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4728	45	101	Off Tortugas	fragments of large colony
4730	269	263	" St. Vincent	young colony, almost complete
4731	276	94	" Barbados	young colony, almost complete
4729	XVII	41	" Honduras	fragments of small colony

Remarks: — The smaller colonies agree fairly well with Duchassaing & Michelotti's figures and it can hardly be doubted that the identification is correct.

4. Scirpearia grandiflora spec. nov.

Plate 24, figs. 37–41

The collection contains a few fragments of a large colony. The tallest is 75 cm. high, exclusive of the base, and the diameter of the stem varies from 2.5 mm. in the lower part to 1 mm. in the upper part. The zooids are large (2–3 mm. high and 1 mm. wide) cylindrical, and curved upward. They are placed laterally in a zigzag to single row, 3 mm. apart in the lower portion of the colony and 2 mm. in the upper part. The coenenchyma is thin; the axis stiff, and concentrically striated.

The color in all cases (in alcohol) is yellow for the zooids and gray for the stem, which becomes pale yellow in the upper part. The longitudinal canals inside the naked bands are distinct as furrows; the axis is pale greyish.

The spicules in the coenenchyma consist of a surprisingly small number of double heads, and a large number of short double rods with large warts; the warts in the inner belt are often distinctly larger. In the inner layer are flat

capstans, slightly warted. The large zooids contain, almost exclusively, long slender rods with warts in irregular belts; the tentacles, short thick blunt double rods with confluent warts.

The double heads measure about 0.06 mm. in length; the double rods as much as 0.09–0.11 mm.; the capstans are of about the same size. The rods in the zooids may also be as much as 0.11 mm. in length; the short rods in the tentacles about 0.08 mm.

Type: — M.C.Z. cat. no. 4732.

Type locality: — Off Martinique, in 191 fms. ("Blake" Sta. 210).

Specimens examined: — Two specimens from the type locality, and a fragment from "Blake" Station 135, in 218 fms.

Remarks: — The spicules in this species resemble somewhat those in *Scirpearia funiculina*, but the latter form has extraordinary small scale-like zooids, even in the large sized colonies, as well as a larger number of double heads; moreover, thick blunt rods are entirely lacking in the tentacles of *S. funiculina*.

5. Scirpearia elongata (Pallas)

Plate **24**, figs. 46–48

Gorgonia elongata Pallas, 1766, p. 179. For list of synonyms until 1910, see Simpson, 1910, p. 325.
Junceella juncea Duchassaing & Michelotti, 1860, p. 34.
Ellisella elongata Kükenthal, 1919, p. 778, 790, 859; 1924, p. 367. — Toeplitz 1929, p. 285.
Scirpearia cylindrica Toeplitz, 1929, p. 306, pl. 7, fig. 7, text-fig. 15.

The collection contains several fragments, about 15–20 cm. long, of a species which, in its outer shape, resembles the figures given by Esper (1797 on plate LII), of Pallas' specimen, and in size and shape of spicules it shows close agreement with the figures given by Simpson of a specimen from the West Indies in the Hunterian collection, London. I have therefore not hesitated to identify it with Pallas' much discussed species.

The fragments are about 3 mm. thick, with very little difference between the upper and lower ends. In one case a basal disk is present, attached to another, denuded axis; zooids are lacking for a distance of about 10 cm. from the basal part, although it seems as if they had once been present. There are also among the fragments two stumps of branches, both arising from the same side near the base. It seems therefore that the species is normally branched, as Esper's figure indicates. The exterior is very striking; a slightly flattened, rusty-red stem, with two crowded bands of pale zooids, closely appressed and scale-like, and

two narrow, naked bands. The zooids are about 1–1.5 mm. high and 1 mm. wide when well developed. They are arranged in oblique rows with as many as five-six in the row; toward the tips, although the stem becomes more flattened and the bands narrower, the zooids still show an arrangement in oblique rows, but with fewer (about three) individuals in the row. The longitudinal canals are arranged in a cylinder around the stem. In some cases there is very little difference in size between them; in others it is quite evident that one pair is larger.

The spicules are relatively small, and in some cases show a tendency toward degeneration. In the coenenchyma there is the typical layer of warted double heads and short double rods; usually the warts in the central rows are larger and distinctly separated. The inner layer consists of flattened capstans with usually numerous warts. In the zooids the rods are fairly broad, elliptical, with numerous small warts and an indistinct, naked, central belt. The latter spicules are often thin with laciniated edge and poorly developed warts. The tentacles contain short rods with distinct belts of warts. There are a few simple rods at the base of the zooids.

The double heads are 0.04–0.05 mm. in length; the short rods, 0.06 mm.; the flat capstans, 0.06 mm.; the zooid rods, 0.07–0.09 mm.; and the tentacle rods, 0.07 mm.

The spicules in the outer layer of the coenenchyma are mostly yellow; the other spicules are almost colorless.

Type: — The type seems to be lost. The large branched colony in the Hunterian collection in London, described by Simpson, has been used as a reference specimen in the present paper.

Type locality: — "Oceanus Atlanticus."

Distribution: — West Indian waters, in 40–120 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4734	155	88	Off Montserrat	fragments
4735	276	94	" Barbados	"
4736	278	69	" "	"
4737	298	120	" "	"
4738	286	45	" "	"
4733	17 Bartlett, 1880.	41	" Honduras	1 fragment
4739	No locality			

Remarks: — The present material seems to agree with the description given by Simpson (1910, p. 325) of a large, branched specimen in the Hunterian col-

lection in London. It also agrees in all essentials with Toeplitz's description and figures of *Scirpearia cylindrica*, except that she does not mention the yellow color of the zooids; furthermore, she indicates that the zooids occur in four bands, although in some parts they seem to be in two rows. The measurements of the spicules agree fairly well.

I have ventured to place *Junceella juncea* Duchassaing & Michelotti as a synonym of Pallas's *elongata*, because it apparently is the only species in the West Indies which resembles *elongata* (determined from Esper's plate LII). If the two authors had before them an unbranched fragment of *elongata* with the naked bands contracted, as I have seen them, it was almost inevitable that they should have referred the specimen to *J. juncea*, although the latter seems to be exclusively Indo-Pacific. The spicules were not examined.

Kükenthal and Toeplitz, (who have not examined any specimen of Pallas' species), state that the coenenchyma is thick compared to the axis ("Die Achse is dünn im Vergleich zur Dicke des Cönenchyms," Toeplitz, 1929, p. 286). This is not in agreement with Esper's or Simpson's figures, nor with the material in the M.C.Z.; Simpson says expressly (1910, p. 327), "the coenenchyma is very thin." But an old label in the Hunterian collection says, "the axis is of a small size in comparison with the crust." (Simpson, p. 326.) Possibly a reference to the living colony.

6. Scirpearia grandis (Verrill)

Plate 24, figs. 42–45

Verrucella grandis Verrill, 1901, p. 53, pl. 9, figs. 1-3.
Scirpearia grandis Kükenthal, 1924, p. 373. — Toeplitz, 1929, p. 314, text-fig. 18.

The type was an enormous specimen at least five feet high with a trunk, 1.2–1.6 cm. wide and with numerous branches. A small fragment of two branches is all that is left of the type in the M.C.Z.

The branch is about 2 mm. wide, slightly tapering toward the tip. It is distinctly flattened, while the trunk is said to be roundish. The zooids are crowded and are placed laterally in double rows; in the lowermost part, in triple rows. They are strongly contracted, low, mamilliform, 3 mm. high and about twice as broad. The longitudinal canals beneath the zooid-free bands are larger than the other canals.

The color is uniformly pale orange when dry; the axis is greyish and strongly calcified.

The spicules in the outer layer of the coenenchyma are double heads and short double rods, characterized by the double to triple warts in the inner row, distinctly separated from the smaller warts in the terminal tufts. In the inner layer are flattened capstans with few warts. The zooids contain numerous, usually slender, pointed rods, thicker at one end, each with an indistinct middle naked belt and numerous small delicate warts at each end. The deposits are thin and delicate, and may possibly represent a degenerated type. The tentacles contain similar, though smaller, rods. The zooids contain also a few simple rods.

The double heads may be as much as 0.06 mm. in length; the capstans are of about the same size. The zooid rods are about 0.10 mm. long, and the tentacle rods about 0.08 mm.

Type: — A fragment in the M.C.Z. (cat. no. 4740).

Type locality: — Off North Rock, Bermuda, in 36 fms.

Distribution: — Bermuda; Florida (Toeplitz).

Specimens examined: — Fragment of the type.

Remarks: — There is a possibility that *Scirpearia grandis* is a uniformly colored specimen of *S. clongata* (Pallas), in which the zooids are completely retracted. It has the same flattened branchlets, the same distribution of zooids, and the same kind of double heads in the coenenchyma. The general aspect of the rods in the zooids, however, is very different, those of *grandis* being much longer and narrower, but it may be that they are still within the possible range of variation. If that be the case, the name *grandis* will necessarily be abandoned.

Note: — Other species in the Atlantic Ocean.

Scirpearia flagellum (Johnson)

Juncella flagellum Johnson, 1863, p. 505.
Scirpearia flagellum Kükenthal, 1924, p. 371. — Nec Toeplitz, 1929, p. 308, text-fig. 16.
Scirpearia ochracea Studer, 1891, p. 559; 1901, p. 53.
Juncella extans Verrill, 1864, p. 37; 1868a, p. 414.

Two species of *Scirpearia* have previously been described from the eastern Atlantic, *S. flagellum* (Johnson), 1863, and *S. ochracea* Studer, 1901, the latter describing and figuring both forms. His figures of the spicules are rather unsatisfactory. His figures of whole specimens show *S. ochracea* as orange-colored with a single zigzag row of zooids, while *flagellum* is shown with two bands of closely crowded zooids. Simpson (1910) united the two forms. Thomson (1927) described and figured *S. flagellum.* He examined large specimens in which the zooids were in zigzag rows, and the color varied from yellow to greyish white.

Thomson's figures of the spicules are excellent, and show that cylindrical rods with large warts predominate, together with double heads. They agree completely with the spicules I have found in a specimen of *S. flagellum* in the M.C.Z. (cat. no. 4741, type of Verrill's *S. extans* from the Azores), with two bands of crowded zooids. I am therefore inclined to think that Simpson is right when he unites *S. flagellum* with *S. ochracea*.

Toeplitz (1929) keeps the two forms separate and reports both of them from the West Indies. She does not seem to have had any east Atlantic material for comparison. Her figures of the spicules indicate that she probably is in error. The spicules of her *S. ochracea* resemble closely those I have found in some of her *S. atlantica*, and those of her *S. flagellum* resemble those in *S. rigida;* at least they have nothing in common with those figured by Thomson for *S. flagellum.*

There are two forms in the West Indies which have spicules somewhat similar to those of *S. flagellum,* namely, *S. funiculina,* which, even in the largest specimens, has diminutive scale-like appressed zooids; and *S. grandiflora,* in which the double heads are practically absent, and the spicules in the tentacles are remarkably thick and blunt.

At present everything seems to indicate that *S. flagellum* (Johnson), including *S. ochracea* Studer, does not occur in the West Indian waters.

Genus 5. Nicella J. E. Gray 1870

Diagnosis, from Kükenthal, 1919, p. 861: — Colony branches vertically in one plane, the branches forming sympodia; branches mostly circular in cross-section, rarely somewhat flattened. The zooids are arranged alternatingly in two rows, closer to the front side; dorsal side usually naked. The verrucae stand vertically and have eight marginal projections. The zooid wall contains spinous double stars and girdled rods, located mostly in the tentacles. In the outer layer of the coenenchyma are double heads and in the inner layer, long flattened spindles.

Type Species: — *Nicella dichotoma* (J. E. Gray).

Remarks: — The group has been thoroughly studied by Toeplitz (1929), who recognizes eight species. Six of these are Atlantic, three being listed from the West Indian region.

The present material includes two species, one of which seems to be new, *N. obesa.* The other, *N. guadalupensis* (Duch. & Mich.), seems to be extremely variable, and I feel sure that it includes *N. ramosa* Toeplitz and most likely also *N. americana* Toeplitz. According to Toeplitz (1929, p. 359), the fourth Atlantic

species, *N. granifera* (Köll.), is so poorly described and figured that it cannot be ascertained whether it is closely allied to the West Indian forms or not. It ranges from West Africa to the Azores, in 318–454 m. Possibly it may be identical with *N. obesa*, and in that case the latter name must be dropped.

No key is given as it is almost impossible to express the differences between these species.

1. Nicella obesa spec. nov.

Plate 37, figs. 1, 1a

The collection contains several fragments, the largest seeming to indicate that the colonies must have been as much as 20–30 cm. high and equally broad. They branch fan-like in one plane, chiefly pseudo-dichotomously, with relatively long, straight or upward curved branchlets. The zooids are sparingly distributed on the stem and larger branches, and stand well spaced in a row on each side of the branchlets, somewhat nearer to the front side. The zooids are stout, cylindrical, except when strongly contracted, and measure about 1 mm. in length and 1 mm. in breadth. They usually show a constriction across the lower part. The tentacles, whether contracted or not, are visible as eight small lobes at the tip.

The color is whitish grey in all the dry fragments. The axis is pale brown and rigid, with somewhat excentrically arranged layers.

The spicules are surprisingly uniform in all the fragments. In the inner layer of the coenenchyma are robust double rods with pointed ends and relatively large warts, separated by a naked girdle, in the outer layer are double heads with thick stalk, in most cases elliptical in outline. The zooids contain short rods with spines, and simple blunt rods with three belts of warts at each end.

The double rods are about 0.15 mm. in length; the double heads as much as 0.07 mm. The basal spinous rods in the zooids measure 0.07 mm.; the blunt rods in zooids and tentacles, 0.03 mm.

Type: — M.C.Z.

Type locality: — Off St. Vincent, in 95 fms. ("Blake" Sta. 231).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4742	128	180	Off St. Croix	1 fragment
4770	134	448	" " "	small fragment
4743	164	150	" Guadeloupe	1 fragment
4769	166	150	" "	1 fragment
4744	231	95	" St. Vincent	several fragments
4768	No locality			

Remarks: — This species, as far as the present material indicates, is well characterized by its large and sparingly distributed zooids, its uniform color, and its strongly warted, pointed, double rods and its oblong double heads. It does not appear to resemble any of Toeplitz's species.

From Studer's figures (1901, pl. 9, figs. 9–10). one gains the impression that his *Verrucella guernei* is very near to *Nicella obesa*. Thomson (1927, p. 54) emphasizes as the characteristic features of *Verrucella* that there are no distinct double heads, and that the rods in the inner layer are not remarkably longer than the deposits in the outer layer, a definition which could be used for *N. obesa*. Kükenthal regards *Verrucella* as a synonym of *Nicella*, and *guernei* as a synonym of the doubtful form *N. granifera* Kölliker. The latter name may eventually be proven to be the proper one for the species here described. Kükenthal's form *N. multiramosa* from West Africa may possibly also be a synonym of *N. granifera*.

2. Nicella guadalupensis (Duchassaing & Michelotti)

Plate 36

Verucella guadalupensis Duchassaing & Michelotti, 1860, p. 33, pl. 4, figs. 5–6.
Nicella guadalupensis Kükenthal, 1924, p. 378. — Toeplitz, 1929, p. 350, text-fig. 22.

Original description: — "Belle espèce, arborescente en éventail étalé. Coenenchyme jâunatre-clair, tandis que les cellules sont blanches; de petites granulations s'aperçoivent sur le restant de la surface. L'axe est blânchatre."

The collection contains about a dozen specimens, partly incomplete, which undoubtedly belong to this form, but there is a large although gradual variation in the size and distribution of the zooids and in the shape of the spicules. It may be possible that the new forms described by Toeplitz will have to be included in this species.

The colonies are as much as 40 cm. high. Most of the lateral branches and branchlets have been broken off, but apparently they were about 20–30 cm. broad. There is a rounded or flattened stem with a number of strong branches of about the same thickness, and, in most cases, fine delicate branchlets which branch repeatedly, pseudo-dichotomously, when the stem is examined. The zooids vary greatly in size. In some of the smaller colonies they are large (about 0.7 mm. by 0.7 mm.), while in the larger colonies they measure about 0.3 mm. by 0.3 mm. They are placed in two rows, which usually alternate and are somewhat closer to the front side. On the branch and stem they are either placed laterally in a single to double row, or they are scattered along the entire surface

of the anterior side. The coenenchyma varies from smooth to finely wrinkled, sometimes in the same colony. A longitudinal vessel may often be visible on the front and back side of the stem and branches, as a furrow.

The color varies (in dry condition) from pale orange, with white zooids, to pale yellow, with zooids of the same color.

The spicules of the coenenchyma consist of an inner layer of blunt to pointed, flat, warted rods, with or without a naked girdle, occasionally unequally developed, more club-like. The outer layer contains double heads. In the colonies with pointed rods and small zooids, the double heads are usually small and have a distinct stalk, whereas they are almost globular and stalkless in the forms which have blunt rods and large zooids; but the conditions may be reversed. The zooids usually contain basal, short, spinous rods, and in the tentacles a large number of short blunt rods, with three rows of low warts near each end.

The flattened rods are about 0.17 mm. long; the pointed rods may be 0.23 mm. in length. The double heads measure about 0.06 mm.; the spinous rods in the basal part of the zooids, about 0.07 mm., and the blunt rods in the upper part and in the tentacles are of about the same length.

Type: — Museum of Turin; some very poor spicules from the type have been examined.

Type locality: — Off Guadeloupe, in deep water.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4771	45	101	Off Tortugas	2 fragments
4745	132	117	" St. Croix	1 small fragment
4746	157	120	" Montserrat	1 fragment
4747	203	96	" Martinique	3 large
4748	231	95	" St. Vincent	2 small
4749	247	170	" Grenada	1 fragment
4750	273	113	" Barbados	2 fragments
4751	276	94	" "	4 medium size
4752	277	107	" "	1 small
4773	290	73	" "	1 "
4772	No locality			2 "

Remarks: — The great variety in the shape of the spicules and the slight differences in the arrangement of the zooids which occur in colonies of the same color pattern and from the same locality, have convinced me that we are probably dealing with one variable species. All of the small colonies have distinctly

larger zooids. They are uniform in color and have spicules which resemble those of *Nicella ramosa* Toeplitz, but the same kind of spicules have been found in larger colonies with small white zooids and orange coenenchyma, collected together with typical *N. guadalupensis*, which has chiefly pointed spicules in the inner layer.

3. Nicella ramosa Toeplitz

Nicella ramosa Toeplitz, 1929, p. 346, pl. 7, fig. 9, text-fig. 21.

This species is characterized by having the colony developed only on one side (possibly an accident). According to the figure, it is a fairly stout form with large scattered zooids and uniform color. The spicules resemble those which I have found in some of the colonies of *N. guadalupensis*, and it may eventually be ranked as a variety of that species.

It was taken off Barbados in 183 m. (most likely "Hassler" material) together with *N. americana*.

4. Nicella americana Toeplitz

Nicella americana Toeplitz, 1929, p. 354, pl. 7, fig. 10, text-fig. 23.

Resembles in its outer form and color *N. ramosa*, but is regularly developed. The spicules of the inner layer consist of oblong pointed rods uniformly covered by warts. Other features appear to be essentially as in *N. ramosa*.

Collected off Barbados in 183 fm.; five colonies (most likely "Hassler" Exp.); Mus. of Munich.

Remarks: — Some of the two-colored colonies of *N. guadeloupensis* have similar pointed rods, but usually with a distinct naked girdle. I am inclined to think that this form is also a variety of *N. guadalupensis*.

Family II. CHRYSOGORGIIDAE

Kükenthal, 1919, pp. 486–551; 1924, p. 383.

Diagnosis, from Kükenthal, 1919, p. 589: — "Gorgonians with simple, non-jointed axis, and mostly branched base, rarely disk-like. The stem is either branched or unbranched. The branches arise from a longitudinal line on the axis and may form a steep spiral. The zooids are either closely placed all over the colony (in the lower part in two rows), or they are widely scattered and placed

in single rows on the branches. The zooids are unable to retract into the coenenchyma and, with the exception of *Trichogorgia,* are never divided into a distinct verruca and a retractile upper part. The tentacles may curl inward to a greater or lesser degree. The main type of the sclerites is the flattened rod which may develop into the slender spindle or into a scale-like plate, often irregularly lobed. Sometimes the outer layer may contain warty, rounded forms, and twin balls (*Riisea*). Color in alcohol, white. Axis often with incrustments of lime; in many cases with strong metallic lustre."

Remarks: — It is very possible that the group is not quite natural, but, as Kükenthal points out, our knowledge of several of the genera and their manner of branching, etc., is so imperfect that we cannot at present give a better arrangement. According to his system the family is divided into seven genera with forty-six certain and twenty-nine uncertain species.

The species from the West Indian waters described here were all known previously from that region, except *Trichogorgia viola* n. sp., which possibly is identical with *T. flexilis* Hickson, collected off South Africa. Two new varieties have been described.

List of Chrysogorgiidae from the West Indian waters and off the east coast of the United States.

Trichogorgia viola spec. nov.
Chrysogorgia desbonni Duchassaing & Michelotti
C. desbonni Duchassaing & Michelotti var. *thyrsiformis* var. nov.
C. fewkesi Verrill
C. elegans Verrill
C. squamata (Verrill)
C. agassizii (Verrill)
Metallogorgia splendens Verrill
Iridogorgia pourtalesii Verrill
Riisea paniculata Duchassaing & Michelotti
Radicipes gracilis (Verrill)

From other parts of the Atlantic Ocean are reported: —

Chrysogorgia affinis Versluys, 1902, p. 47, — new name for *C. spiculosa* Wright & Studer, 1889, p. 9, collected off Pernambuco in 630 m. Versluys thinks that the species is different from the typical West Indian form because he did not find the extreme long rods described by Verrill in the base of the zooid, and because the spicules are, on an

average, smaller (0.56 mm., compared to 0.70 mm. in the "Blake" material).— The large pointed rods, however, are often absent from the base of the zooid in *spiculosa*, and the spicules often show considerable variation in size. It seems quite likely to me that *C. affinis* is identical with Verrill's *C. spiculosa*, or *elegans*, as it now is called.

C. fewkesi, Thomson (1927) off the Azores in 1022 and 2165 m. According to Thomson, near to *orientalis* Versluys.

C. orientalis Versluys, reported by Thomson, 1927, off Cape Verde in 1311 m.

C. flexilis Wright & Studer, reported by Thomson, 1927, off Cape Verde and the Azores in 1477 and 3018 m. It seems from Thomson's remarks that he does not consider *C. affinis* a distinct species, and we may conclude that the form is possibly near to *C. elegans*.

C. pentasticha Versluys, reported by Thomson, 1927, off the Azores in 1425–1968 m. The specimen is in a poor condition. One is inclined to think that it is possibly identical with *C. agassizii* (Verrill), which has flat scales and numerous zooids on the terminal branchlets.

C. agassizii (Verrill), reported by Roule, 1904, from the Gulf of Gascogne. Probably identical with Thomson's *C. pentasticha*.

C. quadruplex Thomson, 1927, off the Azores in 1022 m. (with *C. fewkesi*). The spicules in the zooids are transversally arranged, and it appears to be closely related to *C. fewkesi*, possibly a variety.

Key to the genera of Chrysogorgiidae

From Kükenthal, 1919, p. 496: —

1. Zooids closely set all around the stems, sometimes in two rows..1. *Trichogorgia* Hickson.
1. Zooids irregularly scattered, or in a single row.....2.
2. Colony whip-like, unbranched.....6. *Radicipes* Stearns.
2. Colony branched.....3.
3. Branches simple, unbranched, spirally curved.....5. *Iridogorgia* Verrill.
3. Branches several times pseudo-dichotomously branched.....4.
4. Zooids with numerous, small spicules.....5.
4. Zooids with few, large spicules.....6.
5. Branchlets placed on two sides.....2. *Riisea* Duchassaing & Michelotti.
5. Branchlets placed on one side.....*Pleurogorgia* Versluys.
6. Stem monopodial.....3. *Metallogorgia* Versluys.
6. Stem sympodial.....4. *Chrysogorgia* Duchassaing & Michellotti.

Regarding the genus which is not known from the Atlantic Ocean, see Kükenthal, 1924, p. 386.

Genus 1. Trichogorgia Hickson 1905

Trichogorgia Hickson, 1905.
Malacogorgia Hickson, 1905.

Diagnosis: — Colony branching in one plane; base disk-shaped; axis iridescent, hair-fine in the terminal branchlets. Verrucae numerous and placed on all sides of the branchlets, at least in the terminal parts of the colony. Spicules as thin double disks or double paddles, arranged scale-like, forming one layer in the zooids and coenenchyma. Atlantic, deep littoral.

Type species: — *Trichogorgia flexilis* Hickson, 1905.

Remarks: — For further details see Kükenthal, 1919, pp. 497–500; 1924, pp. 383–385. Two species, referred to two genera, have been described from the waters off South Africa at a depth of about 100 m. Kükenthal places them both in *Trichogorgia*. It seems to me as if *Malacogorgia* is merely a *Trichogorgia* in which the spicules (and the calcareous substance of the axis) have been dissolved. As far as I can see the two species are synonymous, *T. capensis* being merely a larger specimen of *T. flexilis*. (See Hickson, 1905, p. 222, pl. 8, fig. 13; pl. 9, figs. 16–17; and 226, pl. 7, fig. 5; pl. 8, figs. 10–11). A third, doubtful species is reported from the Pacific Ocean.

A single species is here reported from the West Indies; it is very closely related to the type species.

Trichogorgia viola spec. nov.

Plate **22**, figs. 1–3; Plate **23**, fig. 1

The three small colonies in the collection are 6–9 cm. high, with disk-shaped base, firmly attached to bits of dead corals. The delicate stem gives rise to branches in one plane, apparently dichotomously, but actually forming a sympodium. The branchlets are long and hair-fine, and the zooids, most of which have been torn off, are closely placed; but whether in alternating rows or scattered over the surface cannot be ascertained. They are distinctly appressed, obliquely attached, and about 1 mm. high.

The colony is snow-white in alcohol. The axis is bluish iridescent, and largely calcareous. The finer branchlets are pale brownish.

The spicules in the thin coenenchyma and in the zooids are simple flat rods with rounded ends and constricted in the middle. They resemble somewhat the

rods found in *Metallogorgia* but are much smaller. The largest measure about 0.15 by 0.03 mm. The thinness may be due to accidental factors, age, or poor development. It is very likely that in better developed specimens they are thick.

Type: — M.C.Z. cat. no. 4834.

Type locality: — Off western Tortugas, in 43 fms. (Pourtalès Gulf Stream Explor.).

Specimens examined: — Three from the type locality.

Remarks: — The poor condition of the specimens makes it impossible to decide whether they belong to Hickson's *T. flexilis*, taken from similar depth (56 fms.) off South Africa, or not. The genus has not yet been reported from any other locality in the eastern Atlantic.

Genus 2. Riisea Duchassaing & Michelotti 1864

For complete list of references, etc., see Kükenthal, 1919, p. 500; 1924, p. 385.

Diagnosis, from Kükenthal: — The monopodial stem gives rise to several strong lateral branches which divide several times. From these branches originate secondary branches alternatingly from both sides, and these in turn give rise to branchlets in the same manner. The zooids are chiefly arranged on the side of the tip of the branchlets. The axis is provided with short, irregular longitudinal furrows and has no metallic lustre. In the stem and main branches the central core is pronouncedly eccentric in position.

The zooids have thick walls filled with numerous small deposits. When contracted the tentacles are strongly and regularly bent inward. On the larger branches the moderately thick coenenchyma has two longitudinal furrows, one of which runs in zigzag fashion from the base of one branch to the base of the nest, whereas the other furrow is straight (sometimes difficult to observe.)

The numerous sclerites in the coenenchyma are chiefly small double-spheres or cones, arranged in several layers.

Type species: — *Riisea paniculata* Duch. & Mich.

Remarks: — The genus contains only one species which is restricted to a depth of about 88–250 fms. in West Indian waters.

Verrill suggests in his manuscript that the genus be removed from Chrysogorgiidae to near *Gorgonella*. Kükenthal (1919, p. 549) retains its position among the Chrysogorgiidae, but thinks that the whole group is possibly related to the Gorgonellidae.

Riisea paniculata Duchassaing & Michelotti

Plate 22, fig. 9; Plate 23, figs. 8–18; Plate 35, fig. 2

Riisea paniculata Duchassaing & Michelotti, 1860, p. 18, pl. 2, fig. 1, 2, 3. — Kükenthal, 1924, p. 385 (complete list of references).

One of the largest specimens in the collection is about 40 cm. high excluding the base. The outer shape of the colony is so striking that it cannot be confused with any other form.

The stem is long and slender and gives rise to a few long main branches from which in turn arise branchlets, alternately placed. The branchlets usually carry only one zooid which is placed on the side near the tip. The zooid are broadest at the top with a large anthocodia, and resemble, when considered in connection with the slender branchlets, small Dutch clay pipes. The general impression of the colony is that the zooids are stalked. The coenenchyma is smooth and about 0.5 mm. thick on the stem. The longitudinal furrows along the stem and branches, mentioned by Kükenthal in his diagnosis, are sometimes indistinct. A number of smaller solenia are present in the coenenchyma. The axis is hard and brittle, filled with lime, and has a distinctly eccentric core in the stem and main branches.

The color of the colony is pure white or greyish in alcohol; the axis is brownish.

The spicules of the coenenchyma are arranged in several layers, and consist of small double spheres and double cones and a number of flat, warted or spinous rods constricted in the middle. The zooids are filled with similar flat rods and a variable number of double spheres and cones. The deposits grow gradually smaller toward the base of the tentacles.

The double spheres and double cones measure from 0.04 to 0.07 mm.; the flattened rods, 0.15–0.20 mm.

Type: — The type is still preserved in the Museum of Turin.

Type locality: — Off Barbados.

Distribution: — Seems to be fairly common off the Lesser Antilles (Barbados, St. Vincent, Grenada, Montserrat, etc.), in 76 to 262 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4777	155	88	Off Montserrat	one, young
4778	249	262	" Grenada	fragment
4779	269	124	" St. Vincent	"

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4780	272	76	Off Barbados	fragment
4781	276	94	" "	"
4782	277	106	" "	"
4783	297	123	" "	1 and a fragment
4784	298	120	" "	fragment
4785	No locality "Blake"			"
4786	Off Barbados 100 fms. "Hassler"			"

Genus 3. Metallogorgia Versluys 1902

Metallogorgia Versluys, 1902, p. 87.
Dasygorgia (partim) Wright & Studer, 1889, pp. 15, 275.

Diagnosis, Kükenthal, 1919, p. 502: — Colonies with distinctly monopodial stem which gives rise to a few lateral branches, and toward the distal end divides into equally strong lateral branches, apparently in dichotomous fashion and here divides profusely. The strong branchlets which in turn give rise to branches on two sides, form sympodia. The axis is round with a smooth surface and with an extremely pronounced metallic lustre. The coenenchyma is thin with few sclerites and not differentiated into layers.

Type species: — *Metallogorgia melanotrichos* (Wright & Studer).

Remarks: — The genus contains two Indo-Pacific species, one of which occurs also in the Atlantic Ocean. See Kükenthal, 1919, p. 502; 1924, p. 387.

A third species, which possibly is identical with the widespread type species, occurs in West Indian waters.

Metallogorgia splendens (Verrill)

Plate **22**, fig. 4; Plate **23**, figs. 2–7

Dasygorgia splendens Verrill, 1883, p. 25, pl. 2, figs. 6, 6a–b.
Chrysogorgia splendens Kükenthal, 1919, p. 537; 1924, p. 408.

A few fragments of branches, as much as 506 cm. long, are the only specimens in the collection. The branches are rigid and appear to branch dichotomously, in various planes, as many as seven times. The coenenchyma is thin, usually rubbed off. The large zooids (1.5 mm. high) are placed usually one, rarely two, on an internode, with broad base and vertical in position.

The color of the colony is white in alcohol. The color of the branches is golden bronze, very metallic; more dull in the finer branchlets.

The spicules are simple, lozenge-shaped rods, thickest in the middle, sometimes with dentate edge and usually constricted. They are of the same type in the coenenchyma and in the zooids, and are arranged lengthwise. The larger ones may be as much as 0.40 by 0.10 mm.; smaller, thinner plates are present in the tentacles.

Type: — M.C.Z. cat. no. 4835.

Type locality: — Off St. Croix, in 580 fms. ("Blake" Sta. 124); also from Sta. 131, according to Verrill.

Specimens examined: — Some fragments from the type locality.

Remarks: — On account of its incomplete state it is impossible to ascertain the mode of branching. It is therefore merely an assumption to refer these fragments to *Metallogorgia*, but the strong metallic lustre of the stem, the high degree of branching, and the shape of the spicules are points in favor of this determination. The spicules are somewhat larger than in the type species (the largest in the latter according to Wright & Studer, are 0.29 by 0.06 mm.). It is quite possible that the present species will be found to be identical with *M. melanotrichos* Wright & Studer, which was reported first from 425 fms. off Ascencion Island, and later from several hauls off the Azores (Thomson, 1927, p. 23) at somewhat greater depths; also, from the Malayan Archipelago and Hawaii, (see Kükenthal 1924, p. 387).

Genus 5. Chrysogorgia Duchassaing & Michelotti 1864

Diagnosis: — Stem and branches form sympodia; the latter appear to be regularly dichotomously divided. Branches usually branching in one plane, arranged in a screw line along the shorter or longer stem. Zooids scattered; coenenchyma thin; axis metallic or pale iridescent.

Type species: — *Chrysogorgia desbonni* Duchassaing & Michelotti.

Remarks: — Kükenthal, 1924, p. 388, lists a large number of species from both the Atlantic and Indo-Pacific oceans. Several of the forms which he regards as doubtful are perfectly valid, and redescribed in the following pages. It is possible that the robust, rigid, short *C. desbonni* should be placed in a special subgenus, while the other, more elegant, slender, tall forms would be placed in another, but for the present no such separation is made; *C. desbonni* is the only

form which possibly could be mistaken for *Metallogorgia*, but the spicules are entirely different, and I think even if superficially examined, the branching is sufficiently different to prevent a wrong identification.

Key to the species of Chrysogorgia known from the western Atlantic

1. Spicules as pointed, curved rods, transversally arranged in the body of the zooid.....2.
1. Spicules as plates or, in most cases, blunt rods, longitudinally arranged in the body of the zooid.....5.
2. Branches rigid, bent upward.....3.
2. Branches not rigid, almost vertically placed.....4.
3. Branches have tendency to become fan-shaped; numerous short internodes..... 1. *Chrysogorgia desbonni* Duchassaing & Michelotti.
3. Branches not flabellate, not in one plane. Few internodes..... 1a. *C. desbonni* var. *thyrsiformis.*
4. Zooid spicules delicate, with small warts; coenenchyma spicules as short simple rods almost smooth .....2. *C. fewkesi* (Verrill)
4. Zooid spicules large; coenchyma spicules spinose .....2a. var. *multiflora.*
5. Spicules as pointed or blunt spinous rods.....3. *C. elegans* (Verrill).
5. Spicules as flat, blunt-ending plates.....6
6. Spicules as large flat scales. Branches robust with large, vertically placed zooids..... 4. *C. squamata* (Verrill).
6. Spicules as small flat scales. Branches delicate, hair-fine, with long obliquely placed zooids.....5. *C. agassizii* (Verrill).

1. Chrysogorgia desbonni Duchassaing & Michelotti

Plate **22**, fig. 5; Plate **23**, figs. 19–27; Plate **35**, fig. 1

Chrysogorgia desbonni Duchassaing & Michelotti, 1864, pp. 13, 21; pl. 1, figs. 7–8; pl. 4, fig. 5. — Kükenthal, 1919; p. 532 (complete list of references); 1924, p. 404.

C. occidentalis Versluys, 1902, p. 56. — Kükenthal, 1919, p. 523 (complete list of references); 1924, p. 398.

Non *C. desbonni* Pourtalès, 1868, p. 131.

Measurements of the large number of specimens in the collection indicate that about 6–8 cm. in height and about the same in width is the normal size for this species. The stem is short and almost straight, the branches following closely one after another in a spiral. The lower branches are always broken off, but two-three of the upper ones are almost as strong as the main-stem, bent upward, and branch abundantly (5–7 times), the secondary branches being fan-shaped and parallel to each other. The main branch is decidedly bent in a

zigzag fashion and the internodes are well spaced. The branching is pseudo-dichotomous and the internodes decrease in thickness, but even those of the highest order are stiff and brittle. The zooids are small, vertically placed, less than 1 mm. in length, and not numerous; usually each internode carries one. The base is a circular disk.

The color of the colony is dirty white. The stiff axis is usually dark brown and glossy; some specimens are paler.

The spicules of the zooids are curved, spinous, pointed rods, arranged transversely. The base and stem of the tentacles contain similar, though straighter rods, and the tentacles smaller flattened rods. The coenenchyma contains irregular, strongly spiny or warty rods. There is usually some variation in the thickness and spinulation of the spicules.

The spicules in the zooids are about 0.60-0.70 mm. long; those in the coenenchyma, as much as 0.35 mm. in length.

Type: — According to Kükenthal (1919) the type is no longer in the museum of Turin.

Type locality: — Off Guadeloupe, no record of depth; most likely about one hundred fathoms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4836	101	175	Off Barbados	1
4837	203	96	" Martinique	1
4838	224	114	" St. Vincent	1
4839	232	88	" " "	1
4840	238	127	" Cannouan	1
4841	241	165	" Grenadines	1
4842	259	159	" Grenada	1
4843	269	124	" St. Vincent	1
4844	273	103	" Barbados	1
4845	296	84-125	" "	1
4846	297	127	" "	1
4847	299	145	" "	1
4866	XIII.	242	" Tortugas	2
4848	No locality			1

Remarks: — Versluys re-described this common West Indian form under a new name, and Kükenthal followed his nomenclature. It seems certain, however, that Duchassaing & Michelotti described and figured the same species

which Kükenthal had later occasion to examine in the M.C.Z. The figure which the two authors gave cannot represent any other known form. The name *occidentalis* is therefore unnecessary.

1a. Chrysogorgia desbonni var. thyrsiformis var. nov.

The collection contains two specimens which are 5–6 cm. high, with fewer and longer internodes than in the typical form, and with not strictly flabellate branches. They show the same strong tendency to bend upward at an acute angle as in *C. desbonni*, and the zooids and the armature of spicules are the same as in the typical form.

Type: — M.C.Z. cat. no. 4849.

Type locality: — Barbados.

Distribution: — Known only from the waters around Barbados.

Depth: — From 100–288 fms.

Specimens examined: — One specimen collected off Barbados in 100 fms. ("Hassler" Exped.); one specimen from 288 fms. off Barbados ("Blake" Sta. 281), M.C.Z. cat. no. 4867.

2. Chrysogorgia fewkesi Verrill

Plate 23, figs. 41–50

Chrysogorgia fewkesi Verrill, 1883, p. 26. — Kükenthal, 1919, p. 533; 1924, p. 405.
C. desbonni Pourtalès, 1868, p. 131.

The colonies may be as much as 25 cm. in height, with erect zigzag-bent stem, the branchlets, which are placed in a spiral and diverge at right angles from the stem, being spaced about 0.5 cm. apart. The first internode is often more than 1 cm. long; the branch then divides five-seven times; the terminal divisions are long and hair-like. The branching is not strictly in one plane. The zooids are about 1 mm. high and vertically placed, or somewhat slanting on the terminal part of the branches. In the present material there are often two zooids on each internode excepting the first and second.

The color of the colony is white in alcohol. The axis is rigid, pale yellow and iridescent, almost colorless and flexible in the terminal branches.

The spicules in the zooids are slightly curved pointed rods covered by spines, and are transversally placed. Similar rods, arranged lengthwise, are present

in the stem of the tentacles, and smaller flat plates are present in the tentacles themselves. The coenenchyma is covered by slender thin rods, often plate-like.

The spicules in the base of the zooids are about 0.7 mm. long; those in the coenenchyma may be as much as 0.35 mm. in length.

Type: — M.C.Z. cat. no. 4850.

Type locality: — Off St. Vincent, in 573 fms. ("Blake" Sta. 227).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4851	190	542	Off Dominica	1 fragment
4852	190	542	" "	1 "
4853	226	424	" St. Vincent	1 "
4850	227	573	" " "	3 fragments

Remarks: — I have designated all the specimens which have fairly delicate spicules in the zooids and small simple rods in the coenenchyma as *fewkesi* because similar spicules are present in the specimen from St. Vincent, selected as the type. The specimens in which the spicules are larger and more roughly spinose have been placed in the variety *multiflora*.

2a. Chrysogorgia fewkesi var. multiflora var. nov.

Plate **22**, fig. 6; Plate **23**, figs. 51–52

Some of the specimens from Dominica are more robust than the typical form, and have much better developed curved rods in the zooids. The spicules in the coenenchyma are also larger and distinctly spinose. Other features are as in the typical form, *C. fewkesi*. The zooid spicules may be as much as 0.5 mm. in length; the largest spindles in the coenenchyma are 0.45 mm.

Type: — M.C.Z. cat. no. 4854.

Type locality: — Off Dominica Island in 524 fms. ("Blake" Sta. 190).

3. Chrysogorgia elegans (Verrill)

Plate **22**, fig. 7; Plate **23**, figs. 53–59; Plate **33**, fig. 1

Dasygorgia elegans Verrill, 1883, p. 23.
Chrysogorgia elegans Kükenthal, 1919, p. 533 (complete list of references); 1924, p. 405.
Dasygorgia spiculosa Verrill, 1883, p. 23, pl. 2, fig. 5.
Chrysogorgia spiculosa Kükenthal, 1919, p. 537; 1924, p. 407.

The largest specimen is about 25 cm. high with strong zigzag-bent stem, bearing widely diverging branches which divide pseudo-dichotomously as many

as five times; the internodes are long and gradually become thinner. The zooids are large (about 1–2 mm. high), vertically placed, one-two on an internode. In the present material the proximal zooids are distended because of numerous (as many as seventy) eggs or larvae, and the gonocoedium bulges sack-like on each side of the stem.

The stem is pale amber in color and iridescent. The color in alcohol is white. The base is white, branched, and sharply set off from the stem.

The spicules are in the form of longitudinally arranged rods. Most of them are thick, distinctly tapering; some of them are blunt. The surface is covered by small spines. There are smaller, more slender, smooth spicules in the tentacles. A few longer, more slender rods are often present near the base. The coenenchyma contains short, warted plates and rods.

The rods in the zooids may be as much as 0.70 mm. in length; those in the tentacles, about 0.15 mm.; the longest rods measure about 0.90 mm. The coenenchyma spicules are about 0.30 mm. long.

Type: — M.C.Z.

Type locality: — Off Barbados, in 237 fms. ("Blake" Sta. 283).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Exped.*	*Depth (fms.)*	*Locality*	*Specimens*
4855	44	539	Off Florida	3
4856	190	542	" Dominica	1
4857	195	501	" Martinique	3
4858	200	472	" "	1
4859	205	334	" "	1
4860	283	237	" Barbados	2
4861	No locality			3

Remarks: — I have been unable to separate the two forms, *elegans* and *spiculosa*. In several cases Verrill was evidently in doubt as the jars have been labelled with both names. The name *elegans* comes first in the original paper.

Both species have been reported off Hawaii by Nutting (1908, pp. 590, 591), but Kükenthal doubts very much the correctness of his statement.

4. Chrysogorgia squamata (Verrill)

Plate **22**, fig. 8; Plate **23**, figs. 28–33

Dasygorgia squamata Verrill, 1883, p. 24.

Chrysogorgia squamata Versluys, 1902, p. 85. — Kükenthal, 1919, p. 538; 1924, p. 408.

The largest specimen in the collection measures about 20 cm. in height. The stem is bent in an obscurely zigzag fashion, and gives rise to several branches (about seven) in the screw-line between each bend. The branches diverge from the stem at almost right angles and branch repeatedly, not in one plane, 2–3 times in the young colonies and as many as five-six times in the largest colony. The branches are relatively short, giving the colony a compact appearance. The zooids are large (about 1.5 mm. high) bell-shaped or cylindrical. There is about one zooid to each internode. The base, present in one specimen, is developed as an irregular disk.

The color of the colony is yellow in alcohol, white when dry. The axis is pale yellow and iridescent.

A large number of nematocysts occur on the stem, visible as low warts. The spicules are flat, thin plates, arranged lengthwise, with finely dentate margin and delicate radiating structures, often constricted in the middle. The largest scales may be as much as 0.40 mm. in length, but most of them are smaller. Much smaller plates are present in the tentacles.

Type: — M.C.Z. cat. no. 4862.

Type locality: — Off Barbados, in 237 fms. ("Blake" Sta. 283).

Distribution: — From the type locality; also listed from the waters off Montserrat.

Specimens examined: — Three specimens and a fragment from the type locality.

Remarks: — Externally this species is well characterized by its profuse branching, short branches, and large zooids. The spicules are entirely different from those found in the other West Indian forms.

5. Chrysogorgia agassizii (Verrill)

Plate 23, fig. 34–40; Plate 34, figs. 1–2

Dasygorgia agassizii Verrill, 1883, p. 22, pl. 2, figs. 4, 4a–b.
Chrysogorgia agassizii Kükenthal, 1919, p. 530 (complete list of references); 1924, p. 403.

The type is broken at both ends, and the base is lacking. The fragment measures about 22 cm. in height; complete colony may have been about 30 cm. high. It is an erect form with a strong stem bent in a zigzag fashion, several mm. in diameter and giving rise to a branch at each bend; there are about five branches within the curve of each screw. Except for the first internode, the branches are hair-fine and divide only once or twice, with long internodes bearing several

(as many as five) zooids. The zooids are obliquely placed, long and thin, with few spicules.

The axis in the stem is golden iridescent; in the branches, colorless. The color of the colony is white. The base is described as white and branched, connected by a horny joint to the stem.

The spicules in the zooids are flat, slender, blunt spindles, with rounded ends and a constriction in the middle. They are arranged lengthwise, except where the zooid joins the stem; there the spindles are arranged obliquely. In the base of the tentacles they become larger and finely spinous, decreasing in size again in the stem of the tentacles. In the coenencyhma they are small; in most places they have been rubbed off.

The largest smooth scales measure 0.20 by 0.05 mm.; the largest spinous rods, 0.35 by 0.04 mm.

Type: — M.C.Z. cat. no. 4870.

Type locality: — Off Georges Bank, in 1242 fms. ("Blake" Sta. 308).

Distribution: — In American waters known only from the type locality; reported from the Bay of Biscay by Roule (1896, p. 304).

Specimens examined: — The type.

Remarks: — Nutting (1912, p. 55) reports this species from the Hawaiian Islands, but it seems to be a different form. Kükenthal (1919, p. 530) points out that in the Hawaiian form the coenenchyma is thick, with few spicules, whereas in *C. agassizii* it is thin, with numerous spicules.

Genus 5. Iridogorgia Verrill 1883

For list of references, see Kükenthal, 1919, pp. 23, 539; 1924, p. 408.

The type of this genus grows in the form of an elegant upright spiral, from which a single series of long, slender, undivided branches are given off regularly at wide angles on the outer side of the stem, so that they likewise have a spiral arrangement; stem undivided (monopodial).

The zooids are scattered along the branchlets, somewhat far apart; they are verruciform with a swollen base, elongated in the direction of the branch, and filled with slender fusiform spicules. The tentacles are large, not retracted in the specimens in alcohol, and not stiffened by spicules. The coenenchyma is very thin on the branchlets and contains slender fusiform spicules. The stem and basal portion of the branches are covered by small, prominent, rounded, soft

nematozooids having an outer surface composed of a layer of special nettling cells or cnido-cells; these structures also extend over the basal portion of the lower zooids.

Type species: — *Iridogorgia pourtalesii* Verrill.

Remarks: — The type species was collected off Dominica Island, W. I. Two other species are described from the Hawaiian Islands by Nutting (1908, p. 594). In the Atlantic Ocean the genus is known only from West Indian waters.

Iridogorgia pourtalesii Verrill

Plate 23, figs. 60–64.

Iridogorgia pourtalesii Verrill, 1883, p. 26. — List of references, Kükenthal, 1919, p. 539; 1924, p. 409.

The main stem is strong, somewhat rigid, calcareous, growing in a remarkably regular, open, upright spiral or helix. The base was not obtained. The type measures about 20 cm. in height, with a stem 2 mm. thick at its lower end; branches, about 1 mm. wide at base. The axis makes about five revolutions, its apex becoming slender and acute. The branches are numerous, long, slender, delicately tapering, flexible, undivided; they arise very regularly, at intervals of about 3 to 6 mm., in a single row along the outside of the main stem, and spread out laterally and widely, nearly at right angles to the stem, so that the whole coral has a broad spiral form something like the skeleton of a spiral staircase.

The coenenchyma is thin and filled with slender fusiform spicules beneath the surface. The surface is soft and bears numerous minute rounded, elevated, soft verrucae or nematozooids, which cover the main stem and the proximal part of the branches, and extend also over the basal portion of the proximal zooids. The nematozooids gradually become smaller and disappear farther out on the branches; they are filled with nettling cells.

Zooids are not present on the main stem, except rarely when one may occur close to the origin of a branch; on the branches they are placed singly and rather far apart (5–10 mm.) along the upper side. The zooids are mostly broader than the branches on which they are situated; they have a swollen basal part, extending somewhat along the branch; the upper part is verruciform and usually surmounted by the large incurved tentacles, which do not appear to be capable of complete retraction. The proximal verrucae are the largest, and have large tentacles with swollen translucent stems, in which there are only a few slender spicules, close to the base; the pinnulae are elongated, slender, and without spicules. The zooids are filled with slender, nearly smooth, acute spicules, which

are obliquely or transversally arranged in the basal portion but longitudinally placed between the bases of the tentacles at the summit. The coenenchyma contains slender spicules of about the same length.

The larger, upright, fusiform spicules in the distal part of the verrucae may be as much as 0.90 mm. by 0.05 mm.

Type: — M.C.Z. cat. no. 4863.

Type locality: — Off Dominica Island, in 542 fms. ("Blake Sta. 190)."

Distribution: — Off Dominica, Guadeloupe, St. Vincent, and Grenada.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth Sta.*	*Locality*	*Specimens*
4863	190	542	Off Dominica	Branches
4864	230	464	" St. Vincent	"
4865	259	159	" Grenada	"

Remarks: — These specimens are all preserved in the collection. The type, however, which was so beautifully figured by Agassiz (part II, 1886, p. 145, fig. 456a) is now very fragmentary. The specimen from Station 173 (Verrill 1883, p. 28), off Guadeloupe, in 734 fms., is missing, and I think the label for no. 4865, Station 259, off Grenada, must be wrong; 159 fms. is a remarkably shallow depth for this species.

Genus 6. Radicipes Stearns 1883

Radicipes Stearns, 1883, p. 97. For list of references, see Kükenthal, 1919, p. 540; 1924, p. 410.
Lepidogorgia Verrill, 1884, p. 220.
Strophogorgia Wright, 1885, p. 691.

Stalk in all the known species tall, slender, and unbranched. Base usually root-like, lobed or branched, and calcareous. Coenenchyma thin, translucent, filled with slender flattened spicules or oblong scales. Verrucae broadly sessile, prominent, usually oblique, and alternating in two rows; their walls are filled with slender, mostly plain, fusiform spicules, arranged longitudinally or somewhat obliquely, and continuing without much change into the stems of the highly spiculose tentacles.

Type species: — *Radicipes pleurocristatus* Stearns.

Remarks: — The genus is known from the Atlantic as well as the Indo-Pacific Ocean.

Kükenthal recognizes five certain species and lists four which he thinks are doubtful. Among the latter is *R. gracilis* (Verrill). It is very likely that Jungersen

(1917, p. 1183) is right when he regards the latter as identical with *R. challengeri* (Wright), known from off Gibraltar ("Challenger"), and from off the west coast of Greenland.

Radicipes gracilis (Verrill)

Lepidogorgia gracilis Verrill, 1884, p. 220.

Radicipes gracilis Kükenthal, 1919, p. 548; 1924, p. 412 (list of references). — Verrill, 1922, p. 42, text-figs. 10, 10a.

The axis is iridescent, simple, tall, slender, terete, and tapers toward the slender tip. The zooids are large, elongated, often wider than the axis, well apart, obliquely appressed. The colony may be as much as 90 cm. in height. Root processes much branched. Branches are round, hard, calcareous, white, and taper to small slender tips. Color when alive, orange or salmon red.

Zooids filled with slender, mostly plain, fusiform spicules, arranged longitudinally or somewhat obliquely. Spicules of the same type are found in the tentacles.

Coenenchyma is thin and contains thin, oblong, scale-like spicules with constricted middle and rounded ends.

Type: — Probably in U. S. N. M.

Type locality: — Off Georges Bank, in 858 fms. ("Albatross", 1883).

Distribution: — From the type locality and as far south as Delaware Bay, in 731 to 1735 fms.

Specimens examined: — One colony from Nantucket shoals (M.C.Z. cat. no. 5001, gift of U. S. N. M.).

Remarks: — This species, which is rather abundant off the eastern coast of North America, has not yet been taken in the West Indian waters. If identical with *R. challengeri* (Wright), collected off Gibraltar, it may be expected there.

Family 12. ISIDIDAE Gray

For list of references, etc., see Kükenthal, 1919, p. 556; 1924, p. 413.

Diagnosis: — Octocorals variously branched, often unbranched. Axis consisting of calcareous segments (internodes) alternating with "horny" or chitinous segments (nodes) which are usually much shorter. Calcareous segments may be either solid or tubular. Branches may arise either from the calcareous or from the horny segments, sometimes in whorls. Verrucae usually large and prominent, covered with larger or smaller elongated spicules, but sometimes may be small and low, with small spicules; in the former case, the margin

is generally armed with eight spiniform projecting spicules or with eight groups of spines. The tentacles are usually large, stout, and very spiculose; in such cases, not retractile. In some groups, as in the Mopseinae, they are retractile. Spicules either as elongate rods, tapering or needle-shaped, or as small short warty irregular rods or star-shaped bodies. Coenenchyma may be either thick or thin; it may contain a single layer of spicules, all of one general type, or it may have two or more layers of different forms. The base may form a disk, adherent to stones, etc., but in deep-sea species, it is usually divided into root-like branches for anchorage in the mud.

The family occurs mostly in deep water, in all seas except in the Arctic.

List of species of Isididae known from the West Indies, Brazil and off the east coast of the United States: —

Lepidisis caryophyllia Verrill
L. longiflora Verrill
Acanella arbuscula (Johnson)
A. eburnea (Pourtalès)
Ceratoisis ornata Verrill
C. simplex Verrill
C. flexibilis Pourtalès
Primnoisis humilis sp. nov.
Primnoisis rigida Wright & Studer
? Chelidonisis aurantiaca Studer

From the eastern part of the Atlantic Ocean: —

Acanella arbuscula (Johnson)
A. eburnea (Pourtalès)
Isidella elongata (Esper)
I. lofotensis Sars
Ceratoisis grayi P. wright
C. macrospiculata Kükenthal
C. palmae Wright & Studer
C. siemensii (Studer)
? C. grandis Nutting
Primnoisis ramosa Hickson
Chelidonisis aurantiaca Studer
C. capensis (Studer)
See Kükenthal 1924, pp. 413–446.

According to Kükenthal, 1924, p. 414, the family contains four subfamilies, with ten certain and two uncertain genera, fifty-five certain and thirteen uncertain species.

Key to the subfamilies

1. Zooids non-retractile ..... 2.
1. Zooids retractile ..... 3.
2. Zooid spicules consist partly of longitudinally and septally arranged tapering rods or needles ..... 1. *Ceratoisidinae.*
2. Zooid spicules as plates, transversally arranged. The tentacles form an operculum ..... 2. *Mopseinae.*
3. Zooid spicules strongly spinulose ..... *Muricellinae.*
3. Zooid spicules as small, warty, mostly irregular bodies ..... 3. *Isidinae.*

Three subfamilies are Atlantic, the remaining one is Indo-Pacific. See Kükenthal, 1924, pp. 413–446.

Subfamily I. Ceratoisidinae

For references, etc., see Kükenthal, 1919, 560; 1924, p. 414.

Diagnosis: — Branched or unbranched colonies. Zooids nonretractile. Zooid spicules as spindles or needles, longitudinally and septally arranged; also, as short, mostly flattened rods. Branches arising either from the nodes or internodes. Four genera.

Key to the genera of Ceratoisidinae

1. Branches arising from the internodes; or the colony is unbranched, spicules as needles .. 4. *Ceratoisis.*
1. Branches arising from the horny nodes, or unbranched, spicules partly as rods ..... 2.
2. Branching in all directions, whorl-like ..... 3. *Acanella.*
2. Branching chiefly in one plane ..... 3.
3. Branching sparing, dichotomous. Spicules in zooids, flat rods ..... 1. *Isidella.*
3. Branching alternating, or in pairs; or colony unbranched. Spicules in zooids projecting needles ..... 2. *Lepidisis.*

Genus 1. Isidella Gray 1857

For diagnosis, etc., see Kükenthal, 1919, pp. 564–568; 1924, p. 414.

Type species: — *Isidella elongata* (Esper).

Two species, known from the eastern Atlantic; both may be expected in American waters.

Key to the species of Isidella

Compiled from Kükenthal, 1919, p. 566.

Nodes 0.5 mm. high; branching not strictly in one plane; zooids almost vertically placed, club-shaped. Spicules scattered in zooids; no transverse ring or spicules. . . . . 1. *I. elongata* (Esper).

Nodes 1 mm. high; branching in one plane; zooids obliquely placed, cylindrical. Spicules crowded in zooids; transverse ring present. . . . . 2. *I. lofotensis* Sars.

1. Isidella elongata (Esper)

See Kükenthal, 1924, p. 415.

Distribution: — Mediterranean Sea; Gulf of Biscaya, 400–754 m.

2. Isidella lofotensis Sars

See Kükenthal, 1924, p. 415.

Distribution: — West coast of Norway; coast abyss.

Genus 2. Lepidisis Verrill 1883

Lepidisis Verrill 1883, p. 18, pl. 4, figs. 1, 1a-c.-Kükenthal, 1919, p. 569; 1924, p. 416.

Diagnosis: — The axis has long, tubular, calcareous segments alternating with short, horny nodes. It is simple or branched; the branches, when present, arise from the nodes. Base divided into root-like, long, irregular, flat lobes. Coenenchyma thin, with an outer layer of small, oblong, scale-like spicules; sometimes with a few fusiform spicules beneath them, especially around the zooids. The zooids are large and elongated; the margin is armed with about eight long, spiniform, projecting spicules, alternating with the tentacles; their sides are filled with large, fusiform spicules, which are more or less covered externally by small, oblong, scale-like spicules, very similar to those in the coenenchyma. Tentacle stems filled with numerous small oblong blunt spicules.

Type species: — *Lepidisis caryophyllia* Verrill.

Remarks: — This genus is closely allied to *Acanella*, differing mainly in having a layer of small scale-like spicules, both in the coenenchyma and in the zooids. Two valid species, both Atlantic; one doubtful, Pacific.

Key to the species

Stout branches in one plane with stout zooids. Scales, long (0.40 mm.); rods thick (0.20 mm.) wide ..... 2. *Lepidisis longiflora* Verrill.

No branches; zooids slender. Scales small, (0.20 mm.); rods slender (0.10 mm. wide) .....
1. *L. caryophyllia* Verrill.

1. Lepidisis caryophyllia Verrill

Lepidisis caryophyllia Verrill, 1883, p. 18, pl. 4, figs. 1–1c. — Kükenthal, 1919, p. 570; 1924, p. 417.
L. vitrea Verrill, 1883, p. 20. — Kükenthal, 1919, p. 570; 1924, p. 417.

The determination of this species was based upon three specimens of which now only a few small fragments remain. The type still had its basal part with a few anchoring lobes. Another specimen, which was broken at both ends, was one foot long and unbranched. We may therefore assume that the species is not branched. Most of the joints are 45–55 cm. long and slender (1.5–2 mm. in diameter); the horny nodes, a few mm. long. The zooids occur in an irregular row on each side of the stem, about 2.5–4 mm. apart, vertically placed, and about 8 mm. high, trumpet-shaped (most likely accidentally) with a large cluster of tentacles and eight long projecting marginal spines. The coenenchyma is thin and often torn off.

The color of the coenenchyma is pale brownish. The internodes are hollow, white, and have a distinctly fluted surface. The horny nodes are brown.

The spicules of the coenenchyma consist of small, flattened, narrow rods or scales with rounded ends and often narrowed middle, smooth or finely striated (due to age ?). The zooids contain a large number of slender rods with pointed to blunt ends; sometimes the proximal end is broadened, sometimes the middle is thickened; they vary from smooth to finely granulate. In addition, the zooids as well as the tentacles contain a large number of small scales resembling those found in the coenenchyma.

The coenenchyma scales measure about 0.16–0.20 mm.; the narrow spindles in the zooids, mostly between 1.0 and 5.6 mm., some are smaller. The scales in the zooids and tentacles are slightly larger than those in the coenenchyma, namely, about 0.20–0.25 mm. (These measurements are based upon a few spicules only as the material is scarce).

Type: — M.C.Z. cat. no. 4904.

Type locality: — Off Martinique, in 332 fms. ("Blake" Sta. 205).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4903	161	583	Off Guadeloupe	fragment
4904	205	334	" Martinique	"
4896	222	422	" St. Lucia	"
4905	308	1242	" Georges Bank	"

2. Lepidisis longiflora Verrill

Lepidisis longiflora Verrill, 1883, p. 19, pl. 4, figs. 4, 4a. — Kükenthal, 1919, p. 571, pl. 44, fig. 74, text-figs. 245–47; 1924, 417 (complete list of references).

?*Acanella spiculosa* Thomson, 1927, p. 28, pl. 5, figs. 7, 8, 23.

The type is a fragment of a large colony; four branches remain, almost parallel, 20–25 cm. long. From these arise shorter branchlets at acute angles, all in one plane. The internodes are 2–3 cm. long and 0.2 cm. wide. The basal internode, from which the branch arises, is 1.7 cm. long and 0.8 cm. wide. The zooids are mostly 8 mm. long, and are placed in alternating rows on the sides of the branches and branchlets, somewhat closer to one side, and separated from one another by about 0.6 cm. They are somewhat obliquely placed and have distinctly projecting marginal spines. The coenenchyma is tough; rarely torn off as in some of the other forms.

The color of the colony in alcohol is pale brown to yellow. The internodes are snow white; the short nodes are translucent, golden brown.

The spicules of the coenenchyma consist of flattened smooth rods with blunt ends, often constricted in the middle. The zooids contain long, smooth rods with blunt to pointed ends, and also a large number of flat, short, blunt rods, especially in the tentacles.

The spicules in the coenenchyma measure 0.4–0.5 mm. in length; the spindles in the zooids may be as long as 4 mm.; the small blunt rods average about 0.4 mm.

Type: — M.C.Z. cat. no. 4899.

Type locality: — Off Dominica, in 524 fms. ("Blake" Sta. 190).

Specimens examined: — Some large fragments from the type locality, and some small fragments from 805 fms. off Florida and from 580 fms. off St. Croix ("Blake" Sta. 2 and 131, respectively; also from Sta. 25 in 635 fms., north of Cuba); M.C.Z. cat. nos. 4898–4900, 4906.

Remarks: — According to his figures, Thomson's *Acanella spiculosa* Verrill, collected off the Azores in 1968 m., seems to be identical with this form.

Genus 3. Acanella Gray 1870

For list of references, see Kükenthal, 1919, p. 573; 1924, p. 418.

Diagnosis: — Colony richly branched in all directions. The branchlets arise from the horny nodes and are arranged in whorls. The calcareous internodes are always solid, shortest near the bases and longest near the middle of the colony; they are smooth or longitudinally grooved. The zooids are 2–7 mm. high and form an angle of 90 degrees or less with the stem; they are cylindrical or trumpet-shaped, and armed with long slender spicules (1.2 to 3.6 mm. long) and flattened rods, both of which are finely spinulose or warty. In the distal part the spicules are arranged in eight longitudinal rows, and they may partly reach up between the base of the tentacles. The very large and imperfectly retractile tentacles are filled with spicules which, in the stem of the tentacle, are placed longitudinally. The pinnulae are also well filled with longitudinally placed, flattened small rods with dentate margin. The coenenchyma is very thin and contains isolated, finely spinulose spindles.

Type species: — *Acanella arbuscula* (Johnson).

Remarks: — Ten species are recognized by Kükenthal (1919, p. 574). Two are Atlantic forms, apparently occurring both in the eastern and in the western part, but I have had no material with which to compare them. Thomson (1927, p. 26) lists these two forms and gives the differences, which are similar to those I have found. His third species, *A. spiculosa* Verrill, is most likely a *Lepidisis*.

Key to the species of Acanella, known from the Atlantic Ocean

Colonies normally with four branches arising from the nodes; zooids long. Marginal needles approximately as large as the rest ..... 1. *A. arbuscula* (Johnson).

Colonies normally with two branches (rarely with three) arising from the nodes; zooids short. Marginal needles much heavier than the rest ..... 2. *A. eburnea* (Pourtalès).

1. Acanella arbuscula (Johnson)

Mopsea arbuscula Johnson, 1862b, p. 245, pl. 31, fig. 1, 1a.
Acanella arbuscula Kükenthal, 1919, p. 578, pl. 44, fig. 75; 1924, p. 420 (complete list of references).
A. normani Thomson, 1927, p. 27, pl. 1, fig. 21; pl. 5, fig. 2.
A. normani Verrill, 1922, p. 44, pl. 16, figs. 2–4; pl. 17, figs. 3–3a, text-fig. 11.
Isidella arbuscula Kramp, 1932, p. 10.

This common species is well described and figured by the above-mentioned authors. Most of the material in the collection consists of bushy colonies, about 15 cm. high, with the typical lobed base. The stem is erect, usually without

branches from the lower nodes, but it gives rise thereafter to a number of upward bending, strong branches, usually four from each node. From the lower branches often arise three other branches; toward the summit both stem and branches rapidly become slender and finally give off only two branches or branchlets. The internodes are short and thick in the lower part of the colony; higher on the stem they become long and slender. The zooids are obliquely placed, absent on the lower joints, present to the number of one-two, and finally three-four on the distal joints. In all cases they seem to be crowded together, two-three or more on the tips. They are cylindrical, often thicker in the middle, and the marginal spicules do not project to any extent. The coenenchyma is paper-thin, and has often been rubbed off.

The color of the material in alcohol is pale brown. In life they are reported to be orange to salmon colored. The internodes are white, the short nodes dark brown in the proximal part, and almost colorless in the distal part of the branches.

The spicules in the coenenchyma are finely spinulose spindles. The zooids contain several rows of similar slender rods, and the marginals are not much heavier than the others. Small rods are present in the tentacles.

The coenenchyma spicules are about 0.3 mm. in length; the spindles in the zooids measure between 0.9 and 3.0 mm., and are slender (about 0.05–0.8 mm. in diameter).

Type: — Br. M.

Type locality: — Off Madeira in deep water.

Distribution: — Eastern part of the Atlantic; Greenland, and as far south as the coast of New England on the American side.

Depth: — Between 425–2875 m.; mainly in the deep sea (Kramp, 1932).

Specimens examined: — About twenty colonies from 260–1242 fms. off the coast of New England ("Blake" Sta. 306–312); M.C.Z. cat. nos. 4871–4875.

Remarks: — It seems without doubt that the American species is identical with Johnson's form collected off Madeira, and I have followed Kükenthal in uniting *Acanella normani* Verrill with *A. arbuscula* (Johnson). Verrill stated in his first description of *A. normani* that it was nearly related to Johnson's species. In his notes, as well as in his last publication, 1922, he maintains that the two forms are different, but he does not indicate what the differences are.

Thomson (1927) uses the name *A. normani* for specimens from the eastern Atlantic, but gives in error Johnson as author and makes reference to his paper of 1862. From Thomson's excellent comparison between the two species of *Acanella*, it seems quite evident that there is no difference between the species

in the western and in the eastern part of the Atlantic. It is interesting to note that *A. arbuscula* occurs so much farther south in the eastern Atlantic, together with *A. eburnea*, while it appears to be entirely absent in the West Indies where *A. eburnea* is quite common.

2. Acanella eburnea (Pourtalès)

Mopsea eburnea Pourtalès, 1868, p. 132.
Acanella spiculosa Verrill, 1883, p. 16, pl. 4, fig. 5.
Acanella eburnea Kükenthal, 1919, p. 575; 1924, p. 419 (complete list of references).

Closely related to *A. arbuscula*, but much more loosely branched and with two, rarely three branches, arising from the lower nodes. The internodes are usually longer and the zooids are much more scattered; rarely more than one zooid on each internode, and never crowded toward the tips; always one single zooid placed sidewise near the end of the branchlets. The zooids are also much shorter (about 3 mm. long), and the marginal spicules are strongly projecting. The base is generally broad and swollen, due to the eggs which, in *A. arbuscula*, are placed near the middle of the zooid. There is a distinct difference between the stout marginals and the much more slender zooid rods. The thin coenenchyma contains small spinous rods about 0.3 mm. long. The zooids contain numerous slender rods about 0.9 mm. long, and a few, much stouter marginals, as much as 4 mm. in length. Sometimes the latter almost reach the base of the zooid.

Type: — M.C.Z. cat. no. 4876.

Type locality: — Off Sombrero Island, in 517 fms.

Distribution: — West Indies, the Azores; in deep water.

Specimens examined: —

Pourtalès Gulf Stream Explor.

M.C.Z. Cat. No.	*Depth (fms.)*	*Location*	*Specimens*
4876	517	Off Sombrero Island	3 jars with fragments
4877	447	" San Antonio	base only

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4879	29	955	West of Tortugas	fragments
4908	44	539	" " "	"
4880	137	625	Off Fredrickstad	2 jars, fragments
4881	176	301	" Dominica	young, no zooids
4882	V	288	" Santiago de Cuba	fragments

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4883	VII	610	17°28′30″ N. 77°30′00″ W.	3 jars, fragments
4884	XVIII	600	18°20′30″ N. 87°16′40″ W.	2 jars, fragments
4885	XXII	250	19°48′47″ N. 77°22′00″ W.	fragment of stem

Remarks: — The differences which I have found between *A. eburnea* (Pourtalès) and *A. arbuscula* (Johnson) agree completely with Thomson's (1927) findings in regard to the two forms in the eastern Atlantic.

Verrill's notes contain the description of a new species based upon certain specimens which had unusually long and delicate branchlets. The divergence from the typical specimens is so slight that I think it is not permissible to attempt to define even a variety, based upon the evidence of three specimens.

Genus 4. Ceratoisis Wright 1869

For list of references, etc., see Kükenthal, 1919, p. 585; 1924, p. 423.

Diagnosis, partly from Kükenthal: — The colonies are either unbranched, or branched; in the latter case, the branching is sparing and dichotomous, and usually in one plane. The branches always arise from the calcareous internodes. The latter are solid near the base; distally they may be either hollow or solid.

The zooids are somewhat irregularly arranged, but with a tendency toward a biserial arrangement on one side. The zooids are cylindrical with an enlarged distal portion, and certain eight longitudinally placed rows of elongate spindles or needles, either smooth or finely spinulose. They also contain much smaller, flattened rods with rounded ends and sometimes with a constricted middle. In the stomodaeum there are numerous irregular, more or less star-shaped spicules. The large tentacles are not completely retractile; they are packed with small, rod-shaped flattened spicules with denticulate or undulated margin. They are arranged transversally in the tentacle stem and longitudinally in the pinnulae.

The coenenchyma, which is thin in most species, contains relatively few spindles or needles, and a few smaller rods.

Type species: — *Ceratoisis grayi* P. Wright.

The genus is confined exclusively to deep water; Indo-Pacific and Atlantic.

Remarks: — Kükenthal lists seventeen certain and three uncertain species.

Three species occur in the western Atlantic; one of these is not listed by Kükenthal (1924).

Key to the species of Ceratoisis known from the western part of the Atlantic Ocean

1. Unbranching form. Internodes up to 1.5 cm. long and solid, except the youngest joints. Spicules flat, blunt rods, up to 0.6 mm. long.....2. *C. simplex* Verrill.
1. Branching form.....2.
2. Internodes solid, short, 1 cm. long; spicules up to 3.5 mm. long.....
1. *C. flexibilis* (Pourtalès).
2. Internodes hollow, long, 6–7 cm.; spicules up to 4.4 mm. long....3. *C. ornata* Verrill.

1. Ceratoisis flexibilis (Pourtalès)

Isis flexibilis Pourtalès, 1868, p. 132.
Ceratoisis flexibilis Kükenthal, 1919, p. 590; 1924, p. 424 (complete list of references).

The collection contains the type, an almost complete specimen, and several branches from the same locality. The type is about 30 cm. high with a partly broken base, which may have been either disk-shaped or lobed. The stem is 2 mm. wide and divides, V-like, 6 cm. above the base. These two main branches give rise to long branches, at an angle of 45 degrees, which occasionally divide again, not strictly in one plane, and with an interval of 1–3 cm. The internodes decrease from about 1–0.5 cm. in length; they are solid and decrease also in thickness so that the terminal joints are almost hair-like. The nodes are about as long as broad. The branches arise from the internodes. The zooids are crowded in the lower part, with two rows close together, and scattered in the upper part, where they also become smaller. They decrease in length from 2–1 mm.

The color of the colony is pale brown, with white internodes and dark brown nodes.

The spicules in the coenenchyma consist of flat rods with rounded ends and dentate edge; in the zooids they occur as scattered cylindrical blunt rods, not projecting, and of varying length. The tentacles contain small flat rods; the stomodaeum, the irregular, star-shaped bodies, characteristic of the genus.

The coenenchyma rods average about 0.13 mm.; a few are larger. The spicules in the zooids may be as much as 0.6 mm. in length; the tentacle rods are about 0.06 mm.

Type: — M.C.Z. cat. no. 4878.

Type locality: — Off Florida, in 324 fms.

Distribution: — According to Verrill's notes it ranges from Yucatan, Bahia

Honda (Cuba), Florida to St. Croix, but all of these specimens seem to have been lost. It is listed from the Bay of Biscay by Roule (1896, p. 299).

Specimens examined: — The type, and several branches from the type locality.

2. Ceratoisis simplex (Verrill)

Acanella simplex Verrill, 1883, p. 17.
Ceratoisis simplex Kükenthal, 1919, p. 602; 1924, p. 429.
? *Ceratoisis simplex* Thomson, 1927, p. 25, pl. 6, fig. 7 (complete list of references).

The collection contains several fragments of this unbranched species. The largest fragment was 45 cm. long, when first described. The stem is about 1 mm. wide at the lower end and hair-like in the upper end. The pearly-white internodes are solid except the youngest. The larger internodes are 1.5 cm. long, the smaller ones 0.8 cm. The zooids are arranged in an alternating row, crowded in the lower part of the colony and scattered (1–2 per internode) in the upper part. They are 5 mm. to 3 mm. high, obliquely placed, and contain stout rods which may project somewhat beyond the margin. The color is white.

The thin coenenchyma contains flat, blunt rods, slightly spinous; the zooids, a number of long, stout, blunt to pointed rods, finely spinulose, sometimes bent. The tentacles are filled with small, blunt, flat rods, and in the stomodaeum are the characteristic irregular star-shaped spicules.

The spicules measure from 0.65 to 3.5 mm. in the zooids; the tentacle rods, about 0.15 mm. in length. The coenenchyma has been so completely scraped off that I have been unable to measure the average size of the rods.

Type: — M.C.Z. cat. no. 4886.

Type locality: — Off Martinique, in 334 fms. ("Blake" Sta. 205).

Distribution: — Listed in the manuscript from the waters off Yucatan, Havana, Bahia Honda (Cuba), Barbados, and Dominica, but all of these specimens have been lost. Reported by Wright & Studer from Bermuda in 1675 fms. Possibly also from Princess Alice's Bank (Thomson, 1927, p. 25, pl. 6, fig. 7, very briefly described as *C. simplex* n. sp.).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Location*	*Specimens*
4886	205	334	Off Martinique	fragment
4887	285	349	" Barbados	fragments
4888	XXV	635	Long. 83°12′30″ W. Lat. 23°04′00″ N.	fragment
4889	No locality.			"

3. Ceratoisis ornata Verrill

Keratoisis ornata Verrill, 1878, pp. 212, 376; 1883, p. 10, pl. 4, figs. 3–3d; 1922, p. 43, pl. 16, figs. 1–1b; pl. 17, figs. 4–4b. — Mentioned by Kükenthal in 1919 (p. 686), but omitted in 1924.

? C. palmae Wright & Studer, 1889, p. 29. — Kükenthal, 1919, p. 602; 1924, p. 429.

? C. macrospiculata Kükenthal, 1915, p. 122; 1919, p. 600, pl. 46, fig. 82; pl. 47, figs. 83, 84; 1924, p. 428.

The species is described in detail by Verrill in 1922. It is common in deep water off Nova Scotia. It grows to a height of 4 feet and branches sparingly with long, upward curving branches. The internodes are long (as much as 6–7 cm. in length) and hollow; the nodes are short, about as high as broad, and deep brown in color. The zooids are usually crowded, not scattered toward the tips, and vertically placed with a varying number of spicules which sometimes project. The color of the colony is brownish. Spicules as rods and needles; the latter measure up to 4.2–4.4 mm. in length.

The "Blake" collection contains a few joints with several zooids from Sta. 242 in 842 fms. off the Grenadines, which Verrill first (1883) referred to *C. ornata*. Later, in his notes, he referred it to a new species because the spicules were slightly smaller, and the shape of the zooids slightly different. The fragment has been mouldy and has subsequently become so dry that the zooids have fallen off the stem, but the spicules agree with those in the specimens collected off Nova Scotia. I therefore think that there is no reason for establishing a new species.

Type: — M.C.Z. cat. no. 4890.

Type locality: — Off Nova Scotia.

Distribution: — From the waters off Nova Scotia to the Antilles; in deep water.

Specimens examined: — A few colonies from the northern localities, and a fragment from the West Indies (off the Grenadines in 842 fms., "Blake" Sta. 242; M.C.Z. cat. no. 4891).

Remarks: — Verrill states that this species is closely related to *Ceratoisis grayi* Wright (1869), collected off the coast of Portugal, and off Ireland (Stephens, 1909, p. 8). No comparison has yet been undertaken, but in case the two forms are found to be identical the name *grayi* has priority.

C. palmae Wright & Studer, collected off Cape Palmas, West Africa, may possibly be also identical with this form. No figures are given, but the authors state that they had an unbranched fragment before them with erect zooids, hollow internodes, and golden brown in color. The description of the spicules is too general to allow any conclusions.

C. macrospiculata Kükenthal, collected of Cape Verdes, at about 800 fms., may also possibly be referred to *C. ornata* (or *grayi*). It is stated to have longer internodes and spicules up to 6 mm. long.

Note: — From the eastern Atlantic Ocean are described: —

Ceratoisis grayi Wright, 1869, p. 24. Deep water off Portugal and Ireland. Possibly identical with *C. ornata* Verrill (see above).

C. siemensii (Studer), 1878, p. 663, pl. 5, fig. 35. From 48° 58′ N. Lat., 43° 20′ W. Long., in 3259 m. A much branched form with as many as eight branches arising at right angles from the nodes; occasionally with anastomoses. Internodes, 2–6 cm. high, and hollow; zooids about 3 mm. high.

? *C. grandis* Nutting. Reported by Thomson (1927, p. 25) off S. Miquel in 1153 m. Based upon some hollow and furrowed large internodes; no zooids.

Possibly *C. ornata*, *C. grayi*, or *C. palmae* (= *C. ornata*).

C. macrospiculata Kükenthal, 1915, see 1924, p. 428. Off Cape Verdes, 1694 m. Possibly *C. ornata* or *C. grayi*.

For detailed references see Kükenthal 1924, pp. 424–430.

Subfamily II. Mopseinae

See Kükenthal, 1924, p. 431.

Remarks: — Only one of the three genera has been reported from the Atlantic Ocean.

1. Primnoisis Wright & Studer 1887

Diagnosis: — Colony branching in all planes but with some tendency to branch in one plane. Internodes are longer distally than basally, and give rise to branches which usually begin with a node. Zooids scattered, often curved toward stem. Operculum present. Spicules as spindles, plates, or crosses.

Type species: — *Primnoisis antarctica* Th. Studer.

Littoral, or coast abyssal forms; mostly in the southern hemisphere.

Remarks: — Kükenthal (1924, p. 432) lists eight certain and four uncertain species. The genus is here reported for the first time from the West Indies, but the species may possibly prove to be identical with one described from the waters off South Africa. A deep water form is known from off La Plata river.

Key to the species of Primnoisis, known from the western part of the Atlantic Ocean

Zooids with transversal plates in eight longitudinal rows. Plates up to 0.2 mm. wide.....
2. *P. rigida* Wright & Studer.

Zooids with plates irregularly distributed. Plates 0.3 mm. wide....1. *P. humilis* spec. nov.

1. Primnoisis humilis spec. nov.

A few thin branches attached to a piece of dead coral is all that is present in the collection. The lower internodes are about 5 mm. long and 0.70 mm. wide. The branches arise from the internodes, often two to one side, and are bent upward; the nodes are usually higher than wide, and narrow in the middle, possibly due to dessication. The zooids are low, scattered, and appear to be always bent upward and curved inward; they are about 0.5 mm. high. The internodes are white, with low warts on the surface; the nodes are pale brown.

The spicules, which form a thin layer on the branches, occur mostly as narrow spindle-like plates with the outer side and margin covered by numerous simple blunt spines; the inner side is smooth. Similar plates, but broader, more scale-like, and curved, are arranged transversally in the zooids, giving the aspect of a diminutive Primnoid zooid. The operculum is low, conical, with two-three spinous spicules arranged in chevrons. The largest curved plates measure 0.30 mm. in width; the smaller ones in the coenenchyma, between 0.10 and 0.20 mm.

Type: — M.C.Z. cat. no. 4892.

Type locality: — Off Florida, in 101 fms. ("Blake" Sta. 45).

Specimens examined: — Fragments of the type.

Remarks: — The species seems to be closely related to *P. rigida* Wright & Studer, from off La Plata river, 800 fms, and may simply represent a shallow water form of the latter.

P. ramosa (Hickson), from off Cape of Good Hope, 220 fms., has zooids which are not incurved and larger spicules (0.6 mm.), which are much coarser.

2. Primnoisis rigida Wright & Studer

Primnoisis rigida Wright & Studer, 1889, p. 37, pl. 8, figs. 3, 3a; pl. 9, fig. 8. — Kükenthal, 1924, p. 435.

The description of the type specimen indicates that it is a small bushy form, about 12 cm. high with numerous branches. The zooids are small, 0.8 mm. high and inward curved, with eight longitudinal rows of broad scales, 0.2 mm. wide.

Type: — Br. M.

Type locality: — Off La Plata river, 600 fms.

Specimens examined: — The type.

Remarks: — It is possible that this form represents the deep water variety of *P. humilis*. Superficially the two forms are very alike but more material is necessary to decide whether the two forms should be united.

Subfamily III. Isidinae

See Kükenthal, 1924, p. 442.

Remarks: — The subfamily includes two genera only and one of these seems to be restricted to the Atlantic Ocean.

Chelidonisis Th. Studer 1890

Diagnosis: — Dichotomously branched, with branches in one plane. The finely and longitudinally striated internodes give rise near the ends to two branches which start with short nodes. The zooids are somewhat scattered and are distributed over the entire stem, but chiefly in the plane of the branching. They are able to contract into the hemispherical verrucae.

The spicules are small, mostly short double rods or star-shaped bodies, resembling the spicules found in *Isis*. The coenenchyma is thin, more thickened around the base of the zooids.

Type species: — *Chelidonisis aurantiaca* Th. Studer.

At present two species are known, both Atlantic. See Kükenthal, 1924, p. 444.

Remarks: — In his notes Verrill established a new genus with a single species. But it seems evident from the description that he was dealing either with Studer's *C. aurantiaca* which, according to Kükenthal, is probably identical with Duchassaing's (1870, p. 18) *Melithaea occidentalis* from the Antilles, or *C. capensis* Th. Studer, from South Africa at 46–92 meters depth.

Verrill's specimen has been lost. It was collected off Sand Key by the Bahama expedition (University of Iowa, no. 2429). The description is too general to be of any help in deciding the matter. A key is given to both the known species.

Key to the species of Chelidonisis known from the Atlantic Ocean

Anthostele with small, doubleheads or double clubs, diameter about 0.06 mm..... 1. *C. aurantiaca* Studer.

Anthostele with spindles or clubs, about 0.3 mm. long.....2. *C. capensis* (Studer)

1. C. AURANTIACA Studer

Chelidonisis aurantiaca STUDER, 1890, p. 553. — KÜKENTHAL, 1924, p. 445 (complete list of references).

Type: — Probably in Monaco.

Type locality: — Off the Azores.

Distribution: — Off the Azores, West coast of Ireland. Possibly the West Indies.

Depth: — From 454–1332 ms.

Specimens examined: — A fragment in Br. M., from 40° 05′ N, 9° 57′ W, 1241 m., identified by Studer.

Remarks: — Kükenthal, 1924, p. 64, suggests that Duchassaing's *Melithaea occidentalis* (1870, p. 18) is this species, but with no material for comparison it cannot be proved.

2. CHELIDONISIS CAPENSIS (Studer)

Isidella capensis STUDER, 1878, p. 664, pl. 5, fig. 36.
Chelidonisis capensis KÜKENTHAL, 1924, p. 445.

Type: — Possibly in Germany.

Type locality: — Off South Africa, 46–92 m.

Distribution: — Known only from the waters around South Africa.

Specimens examined: — None.

Order V. PENNATULACEA

Diagnosis: — Freeliving, colonial Octocorals, consisting of a tall primary individual, the oozooid, which is divided into a lower, mostly barren part, the stalk, which anchors the colony in the soft bottom, and an upper part, the stem, which carries the secondary individuals, viz., the autozooids which are complete with eight tentacles, etc., and develop the sex products,— and the siphonozooids, which are incomplete, usually lacking tentacles, etc. (In some forms a second type of reduced individuals occurs, the mesozooids.) Body strongly muscular and spicules reduced to three-flanged or smooth needles or flat rods, plates or grains, smooth or warted, and almost absent in some forms. A horny or calcareous axis is present in most species, in the strongly modified body of the oozooid. Occur in almost all seas, from shallow water to extreme depth.

Remarks: — The order has been well worked out. In 1872 Kölliker prepared his thoroughly modern monograph, and in 1904 Jungersen undertook

a revision of the forms in the Atlantic Ocean. In 1910 Balss reviewed the Indo-Pacific forms, and in the following year, Kükenthal & Broch published the "Valdivia" report, and included diagnoses of all the families and most of the genera, a list of all known species, charts with the geographic distribution, and references to the entire literature. A condensed monograph, by Kükenthal, appeared in 1915, and the following year Hickson published the "Siboga" report, with discussions on relationship, terminology, etc.

The "Blake" collections contain relatively few of the forms known from the West Indies and adjacent waters, most likely (as Verrill points out in his notes) because few hauls were made on the soft bottom where these animals are usually found. Very little has therefore been added to our knowledge of this group in the West Indies and along the east coast of North America; (the Brazilian coasts are practically unknown except for a few shallow water forms). The material is, moreover, in poor condition and most forms have been so thoroughly redescribed, figured, and discussed by the various authors that it would be a useless repetition to describe them once more. Very little emphasis has therefore been laid on descriptions, but an attempt has been made to compile a list of all the species hitherto reported from this area, including some species which undoubtedly exist there. Hickson's system has been followed almost exactly, while extensive repetition of the literature has been avoided by giving, in most cases, a reference to Kükenthal's condensed monograph of 1915, which has almost complete lists of synonyms and is a paper which is found in most larger libraries.

As the order is rather small with few representatives, the complete list of species is given as a whole, instead of dividing it into smaller lists under each family as has been done under the horny corals.

List of Pennatulacea known from the West Indies, Brazil, and off the coast of New England.

Renilla reniformis (Pallas) forma *typica* and forma *americana*
R. mülleri (Kölliker)
Kophobelemnon stelliferum (O. F. Müller)
Funiculina quadrangularis (Pallas)
Protoptilum carpenterii Kölliker
Distichoptilum gracile Verrill
Scleroptilum grandiflorum Kölliker
Umbellula güntheri Kölliker
U. lindahlii Kölliker
Stylatula elegans (Danielssen)

S. antillarum Kölliker
S. brasiliensis (Gray)
Virgularia mirabilis (Linnaeus)
V. kophameli May
Anthoptilum grandiflorum (Verrill)
A. murrayi Kölliker
A sertum (Verrill)
Balticina finmarchica (M. Sars)
B. christii (Koren & Danielssen)
Acanthoptilum pourtalesii Kölliker
A. agassizii Kölliker
Pennatula grandis Ehrenberg
P. aculeata Danielssen
P. aculcata var. *laxa* Verrill
Gyrophyllum hirondellei Studer

For a list of the species known from the other parts of the Atlantic Ocean, the reader is referred to Jungersen's paper 1904 for the northern forms and Studer's 1901 and Thomson's 1927 for the species occurring in the waters around the Azores, etc.

Key to the families of Pennatulacea. (Adapted from Hickson, 1916)

1. Rachis radially symmetrical. Axis present, rudimentary or absent ..... *Veretillidae.*
1. Rachis bilaterally symmetrieal ..... 2.
2. No axis ..... 3.
2. Axis present ..... 4.
3. Rachis cylindrical or club-shaped ..... *Echinoptilidae.*
3. Rachis flattened, leaf-shaped ..... 1. *Renillidae.*
4. Autozooids irregularly distributed, or arranged in longitudinal to transversal rows on the stem, but not united into leaves ..... 5.
4. Autozooids arranged in one or more whorls or bilateral pairs, or united into smaller or larger leaves ..... 8.
5. Autozooids few, large, irregularly scattered on the mostly club-shaped stem ..... 2. *Kophobelemnonidae.*
5. Autozooids comparatively small and numerous ..... 6.
6. Autozooids of various stages, arranged in indistinct rows on the slender stem, and not appressed. Anthostele with numerous needles ..... 3. *Funiculinidae.*
6. Autozooids of same size or ventrally smaller, arranged in longitudinal or oblique to transversal rows on the stem, and strongly appressed. Anthostele sometimes united with the stem ..... 7.

7. Autozooids arranged in one or more longitudinal rows. Anthostele with indistinct to distinct teeth.....4. *Protoptilidae.*
7. Autozooids arranged in short, oblique to almost transverse rows. Anthostele with very long pointed teeth.....*Stachyptilidae.*
8. Autozooids arranged in one or more whorls or in well separated pairs.....9.
8. Autozooids arranged in vertical to oblique rows or united into smaller or larger leaves. 10.
9. Autozooids form several tufts or pairs.....5. *Chunellidae.*
9. Autozooids form one single terminal tuft.....6. *Umbellulidae.*
10. Autozooids united into well developed, sickle-shaped or kidney-shaped leaves. Feather-like to whip-like forms.....11.
10. Autozooids arranged in transverse or oblique rows, or united into small leaves. Slender, whip-like forms.....12.
11. Siphonozooids on the leaves.....11. *Pterocididae.*
11. Siphonozooids not on the leaves.....10. *Pennatulidae.*
12. Autozooids form distinct leaves, immature leaves crowded in the lower part of the stem. The final number of autozooids appears very early in the leaves. Dorsal radial canals... 7. *Virgulariidae.*
12. Autozooids form indistinct leaves.....13.
13. Autozooids soft, cylindrical, lacking spicules completely; leaves irregularly developed and only the basal part of the autozooids is united. Dorsal radial canals[1] .8. *Anthoptilidae.*
13. Anthostele filled with spicules which form two strong teeth. Ventral radial canals..... 9. *Baltieinidae.*

Remarks: — The two first mentioned families have not yet been found in the West Indies, but very likely they do occur there. The Stachyptilidae seem to be exclusively Indo-Pacific.

VERETILLIDAE Herklots

Diagnosis: — Zooids without rigid lower part; sclerites rod or plate-like.

For diagnosis, etc., see Kükenthal & Broch, 1911, p. 168; list of species and geographic distribution and literature, pp. 445–447; chart 2, p. 474.

No members of this family have yet been reported from the western part of the Atlantic Ocean, but *Veretillum* and *Cavernularia* are both represented in the eastern part at fairly low depth, 60–90 m. See Kükenthal, 1915, p. 6; Hickson, 1916, p. 38.

ECHINOPTILIDAE Hubrecht

Diagnosis: — Zooids with rigid lower part; sclerites three-winged needles.

For diagnosis, etc., see Kükenthal & Broch, 1911, pp. 195, 447; chart 3, p. 475; Hickson, 1916, p. 56.

[1] Only one species has been examined as to this character (*Anthoptilum malayense* Hickson).

One genus, *Actinoptilum* with one species is described from 73 m. off South Africa. See Kükenthal, 1915, p. 20.

Family 1. RENILLIDAE Gray 1860

Diagnosis: — Pennatulacea with sterile stalk without any supporting rod, and flat frond with autozooids and siphonozooids arranged on the upper dorsal side only. Spicules as shorter or longer rods or needles, often three flanged.

Remarks: — One genus with two littoral species from the east and west coasts of North and South America. See Kükenthal, 1915, p. 21.

Genus 1. Renilla Lamarck 1816

Diagnosis: — Bilaterally developed colonies with flat, roundish frond; deep incision for the stalk; zooids placed on upper side only; no axial rod. Autozooids with rudimentary calicles with three-seven more or less distinct teeth. Spicules as rods, more or less distinctly three-winged, often twisted.

Type species: — *Renilla reniformis* (Pallas).

Remarks: — An exclusively American genus, known from both sides of the continent, as far north as California on the west and Cape Hatteras on the east, and extending to the Straits of Magellan on the south; littoral forms.

Kükenthal and Broch, 1911, p. 208, have given the history, etc., of the genus *Renilla*. According to these two authors there are four valid species. As far as I am able to discover there are only two distinct species, one of which may have to be divided into three forms.

In 1915 Kükenthal lists furthermore nine doubtful species. They are most likely all synonyms of other species, as is also *R. violacea* Quoy et Gaimard which he has overlooked. Gray's doubtful species from "Australia?" was based on a specimen which was sold to the British Museum by the same person who also supplied the material from Brazil, and the colony resembles exactly the colonies of *R. mülleri*. Most likely a case of wrong labelling.

Key to the species and forms of Renilla

1. Frond kidney shaped. Stalk relatively short. Spicules, in stalk approximately as long as those in the frond.....1. *R. mülleri* Kölliker.
1. Frond round or heart-shaped. Stalk relatively long. Spicules, in stalk short and broad rods, in frond long slender needles.....2.

2. Five calicinal teeth in autozooids. Deep violet with bright yellow and violet spicules.. 2b. *R. reniformis* forma *köllikeri* Pfeffer.
2. Seven calicinal teeth in autozooids.....3.
3. Deep violet with spicules violet and yellow..... 2a. *R. reniformis* forma *americana* Lamarck.
3. Pale rose colored, spicules colorless, a few pale red. 2. *R. reniformis* (Pallas) forma *typica*.

1. Renilla mülleri Kölliker

Renilla mülleri Kölliker, 1872, p. 106.—Kükenthal & Broch, 1911, p. 211 (complete list of references).—Kükenthal, 1915, p. 22.

Renilla amethystina Verrill, 1864, p. 29; 1868, p. 378, pl. 5, fig. 1. — Hickson, 1930, p. 225. Non *R. amethystina* Kükenthal & Broch, 1911, p. 209. — Kükenthal, 1915, p. 23.

Renilla danae Verrill, 1864, p. 29. — Kükenthal, 1915, p. 25.

Renilla patula Verrill, 1864, p. 29. — Kükenthal, 1915, p. 25.

Renilla peltata Verrill, 1864, p. 29. — Kükenthal, 1915, p. 25.

Renilla chilensis Philippi, 1893, p. 3 (in An. Mus. Chile). — Kükenthal, 1915, p. 26.

? *Renilla inermis* Pfeffer, 1886, p. 60. — Kükenthal, 1915, p. 25.

? *Renilla africana* Kölliker, 1872, p. 293, pl. 20, fig. 178. — Kükenthal, 1915, p. 25.

? *Renilla deshayesii* Kölliker, 1872, p. 283, pl. 20, fig. 168. — Kükenthal, 1915, p. 25.

? *Renilla mollis* Kölliker, 1872, p. 279, pl. 20, fig. 175. — Kükenthal, 1915, p. 24.

? *Renilla violacea* Quoy & Gaimard, 1826, p. 642, pl. 36, fig. 68 (reproduced in Cuvier, Règne d' Animal, 1837, pl. 31, figs. 3, 3a–b.

The species is well described by Kükenthal & Broch, and the most important characters are mentioned in the key above. The spicule varies in color; the violet tinge is often more delicate in young specimens. White colonies have been observed by both Verrill and Hickson, as occurring among the typical specimens from Panama, but nevertheless the spicules were found to be violet.

Type: — Probably in Germany.

Type locality: — Brazil.

Distribution: — Gulf of Mexico, Venezuela, Brazil, coast of Chile, west coast of Central America.

Specimens examined: — The types of *R. danae*, *patula* and *peltata*, and a large number of specimens, from Panama; M.C.Z. cat. nos. 4236–4291. Also a number of specimens from Chile, received through the U. S. N. M.

Remarks: — The types of Verrill's species have all been examined, also some good specimens from Chile, which leaves no doubt about the identity of Philippi's species.

Three of Kölliker's species seem merely to be aberrant specimens of *R. mülleri*. He suspected himself that the label for *R. africana* was wrong and that the specimen came from America. The type of *R. violacea* seems to be lost, but the figures given by Quoy and Gaimard suggest very much *R. mülleri*.

2. Renilla reniformis (Pallas) forma typica

R. reniformis Pallas, 1766, p. 374. — Kölliker, 1872, p. 98 (partim). — Verrill, 1864, p. 12; 1883, p. 533. — Wilson, 1883, p. 723. — Moroff, 1902, p. 399. — Kükenthal, 1915, p. 22 (partim).

Type: — Most likely lost.

Type locality: — Coast of Carolina.

Specimens examined: — Six from North and South Carolina; also some specimens from Northern Florida, (U. S. N. M.).

Remarks: — Kölliker has already noticed the pale color of this northern form.

2a. Renilla reniformis (Pallas) forma americana Lamarck

R. reniformis (Pallas), see Kükenthal & Broch, 1911, p. 207 (partim). — Kükenthal, 1915, p. 22 (partim).

R. americana Lamarck, 1816, p. 428 (partim). — Dana, 1846, p. 588, pl. 57, fig. 1 (partim).

R. edwardsii Kükenthal & Broch, 1911, p. 210. — Kükenthal, 1915, p. 22.

Type: — Apparently lost.

Type locality: — Coast of Brazil.

Remarks:—Kükenthal and Broch examined nine specimens from Brazil, the Straits of Magellan, and the west coast of Central America. They also examined a Brazilian specimen which they called *R. edwardsii* Herklots. Judging from Kölliker's figure, it seems as if this species is merely a specimen of *R. reniformis*, with an unusually large number of zooids, and the spicules figured by Kükenthal and Broch resemble also those I have seen in the northern forms of *R. reniformis*. I do not think *R. edwardsii* can be maintained.

R. reniformis is erroneously listed by the two authors from off southern California, on Pfeffer's authority, the only existing record; but there is only one form of *Renilla* in that region. Pfeffer described his specimens as *R. köllikeri* and Kükenthal and Broch named all their specimens *R. amethystina* (nec Verrill). In 1913 Kükenthal corrected the error.

2b. Renilla reniformis (Pallas) forma köllikeri Pfeffer

R. köllikeri Pfeffer, 1886, p. 60.

R. amethystina Kükenthal & Broch, 1911, p. 213 (nec *R. amethystina* Verrill). — Kükenthal, 1913, p. 264; 1915, p. 23.

Type: — Hamburg.

Type locality: — San Diego, California.

Distribution: — Coast of California.

Specimens examined: — Several from La Jolla. (G. H. Parker coll.).

Remarks: — This striking deeply colored form seems to resemble the South American form in all respects except in the low number of calicinal teeth. It seems to occur nowhere outside of California and to have a similar isolated occurrence as the pale form from South and North Carolina.

Family 2. KOPHOBELEMNONIDAE

For diagnosis, etc., see Kükenthal, 1915, p. 26. — Hickson, 1916, p. 71.

The family includes three genera which occur in the Indo-Pacific, only one of these, *Kophobelemnon*, occurs also in the Atlantic Ocean.

Kophobelemnon Asbjörnsen 1856

For literature, etc., see Kükenthal, 1915, p. 29.

Diagnosis: — Medium sized colonies mostly around 10-20 cms. length, rarely up to 78 cm. Stem more or less distinctly club-shaped with large autozooids mostly irregularly scattered and completely retractile; anthostele flush with the surface of the stem and with indistinct blunt teeth. Siphonozooids with small calicles, scattered over the stem, leaving a dorsal band free. Spicules as needles or rods, three-flanged to flat or spinous, very conspicuous in the tentacles. Deep littoral to deep sea.

Type species: — *K. stelliferum* (O. F. Müller).

Remarks: — Three or four species are known. The variable type species is the only form known from the Atlantic Ocean and it occurs widespread in the northern part, including off the coast of North America.

Kophobelemnon stelliferum (O. F. Müller)

Pennatula stelliferum O. F. Müller, 1776, p. 255.

Kophobelemnon stelliferum Kükenthal, 1915, p. 29, text-figs. 40, 41 (complete list of references). — Hickson, 1916, p. 71.

Kophobelemnon heterospinosum Kükenthal, 1910, p. 55; 1915, p. 30, text-figs. 42–43.

The U. S. N. M. has a good series of this species, identified as *K. scabrum* and *tenue* Verrill. The species has been so well worked over by Kükenthal & Broch that nothing of importance can be added. The material shows the exist-

ence of similar twisted rods with serrated edges as those figured by Kükenthal for *K. heterospinosum* from off Sumatra. The character, siphonozooids much larger in the lower part of the stem cannot be relied upon. Possibly the immature autozooids have been mistaken for siphonozooids.

Type: — Probably lost.

Type locality: — Oslo Fjord, Norway.

Distribution: — Northern Atlantic, including the Mediterranean Sea, also known from Japanese waters, and south of Sumatra.

Depth: — From 20 to 200 fms. In American waters the species seems exclusively to live in deeper water.

Specimens examined: — The types of *K. scabrum* and *tenue* and several other colonies in U. S. N. M.; also some from Norway and Japan.

Family 3. FUNICULINIDAE Gray

See Kükenthal & Broch, 1911, pp. 240–254, chart, p. 479. — Kükenthal, 1915, p. 33. — Hickson, 1916, p. 94.

Diagnosis: — Bilaterally developed seapens with autozooids in clusters or isolated on the sides of the slender stem. Unusually large siphonozooids scattered in between. Spicules in zooids large three-flanged needles, shorter in the stem and almost reduced to short plates or grains in the stalk. Axis squarish in cross section.

Remarks: — Only one genus, *Funiculina,* is recognized with probably three species; one of these, the type species, occurs widespread in the Atlantic Ocean.

Funiculina Lamarck 1816

Diagnosis: — As for the genus.

Type species: — *Funiculina quadrangularis* (Pallas).

Remarks: — The type species occurs widespread in the eastern part of the Atlantic Ocean. Under the name *F. armata* it was described by Verrill, from Cape Sable, Nova Scotia, and later from the West Indies. Jungersen, 1904, p. 50, united *F. armata* under *F. quadrangularis,* but Kükenthal & Broch, although they had no material from the western Atlantic before them, re-established Verrill's species and gave a detailed description, based upon a colony from off Sumatra. This "*armata*" seems to be a different species. A third form is known from the west coast of North and Central America (*F. parkeri* Kükenthal).

Funiculina quadrangularis (Pallas)

Pennatula quadrangularis Pallas, 1766, p. 372.

Funiculina quadrangularis Kükenthal & Broch, 1911, p. 243, pl. 15, fig. 12 (complete list of references). — Kükenthal 1915, p. 34, figs. 45–46.

Funiculina armata Verrill, 1879, p. 240; 1883, p. 6, pl. 1, fig. 4. Nec Kükenthal & Broch, 1911, p. 250, pl. 20, fig. 47 and Kükenthal, 1915, p. 35, text-fig. 47.

The collections contain some of the material which Verrill described in 1883, but it is in very poor condition. One of the largest colonies, which is now reduced to a naked axis is 35 cm. long; the other colonies are 15–20 cm. long. The axis is not rigid and it shows distinctly a curvature in the upper part; it is distinctly squarish in cross section throughout its greater length. The autozooids are about 4 mm. high (in the type from Cape Sable they measured 6 mm. but that colony was much larger). They are cylindrical or trumpet-shaped with eight projecting spines and a more or less distinct transversal ring of spicules below the marginal spines. The autozooids are arranged in small clusters, usually two large and two small individuals together. Sometimes there is an unpaired small autozooid between the clusters. The siphonozooids are placed irregularly on the stem in the space between the clusters. The color of the colony is white with bluish zooids.

The spicules in the autozooids consist of long, slender three-flanged needles, up to 0.7–0.9 mm. in length. In the coenenchyma are similar but much shorter and often more blunt rods, about 0.4 mm. long, in the stalk short rods three flanged or flat, and about 0.06 mm. long.

Type: — Probably lost. (The type of *F. armata* may still be in the U.S.N.M.)

Type locality: — Atlantic Ocean. *F. armata* came from Cape Sable, Nova Scotia.

Distribution: — Off the coasts of Europe, Mediterranean Sea; east coast of North America and in the West Indies. Also reported from the Indo-Pacific.

Depth: — According to Jungersen it is recorded, in the eastern part of the Atlantic Ocean, from 10–30 fms. In the western part all records are from about 400 to more than 1500 fms.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4355	33	1568	Off Yucatan	1 (denuded axis)
4341	135	450	" Fredriksted	4
4338	136	508	" St. Croix	2

Remarks: — None of the colonies from the western part of the Atlantic have been so large as those recorded from the eastern part, but the material agrees in all respect with the descriptions given by various authors of younger colonies of *F. quadrangularis*, and I have therefore not hesitated in following Jungersen and unite *F. armata* with *F. quadrangularis*. Kükenthal & Broch's *F. armata* from off Sumatra is most likely another species. It lacks the curvature of the axis and has a much longer stalk and much smaller spicules in the latter.

Family 4. PROTOPTILIDAE Kölliker

Kükenthal & Broch, 1911, pp. 254, 451, chart 7, fig. 481. — Hickson, 1916, p. 96.

Diagnosis: — Bilaterally developed seapens with isolated autozooids, laterally, sometimes also ventrally placed on the slender stem, not supported by thickened folds. Calicles obliquely developed. Siphonozooids developed between autozooids, and also on the dorsal side of the stem. Autozooid spicules three-flanged.

Remarks: — North Atlantic, Indian Ocean, coast of California; deep sea. Two genera are recognized, with seven and one species respectively. Both genera are represented in the Atlantic Ocean.

Key to the genera

Autozooids laterally and ventrally placed in close sequence; in the lower part, in oblique rows. Siphonozooids numerous ..... 1. *Protoptilum.*

Autozooids in single rows along the sides. Siphonozooids two to each autozooid ..... 2. *Distichoptilum.*

Protoptilum Kölliker 1871

For list of references, etc., see Kükenthal, 1915, p. 37. — Hickson, 1916, p. 97.

Diagnosis: — Slender, bilaterally developed seapens with autozooids closely appressed and partly coalescent with the stem, with rigid anthostele, and arranged in longitudinal rows which increase in number as the colony grows older. Siphonozooids in narrow to broad bands on the dorsal side with a median streak bare, and also scattered among the autozooids on the ventral side. Spicules as slender needles in stem and anthostele; shorter rods in the tentacles and also sometimes in bands in the lower part of the anthocodia.

Type species: — *P. carpenterii* Kölliker.

Remarks: — Four species are known from the Atlantic Ocean (one of these seems doubtful), and one has been collected off New York. A key is given to the three species, as they all may possibly occur in the western part of the Atlantic.

Key to the species of Protoptilum, known from the Atlantic Ocean

1. Anthostele with pointed teeth.....P. *denticulatum* Jungersen.
1. Anthostele with indistinct or blunt teeth.....2.
2. Anthocodia with spicules in bands on the external side of the body.....
1. *P. carpenterii* Kölliker.
2. Anthocodia with no spicules in the body wall.....*P. thomsonii* Kölliker.

1. Protoptilum carpenterii Kölliker

Protoptilum carpenterii Kölliker, 1872, p. 196. — Jungersen, 1904, p. 52, pl. 1, figs. 2–3. — Kükenthal & Broch, 1911, p. 451. — Kükenthal, 1915, p. 38. — Hickson, 1915, p. 97.
Protoptilum aberrans Kölliker, 1880, p. 28, pl. 8, fig. 30. — Verrill, 1882, p. 312 (in a foot note).

This species, characterized by its red spicules, round axis and cornucopia-shaped calicles with indistinct teeth in variable number and spicules in longitudinal rows on the external side of the anthocodia, was taken by the Challenger expedition south of New York in 1700 fms. Verrill's record, from much shallower water, has not been verified. Jungersen, who had occasion to study a large number of colonies of *P. carpenterii*, withdrew *P. aberrans* as a synonym, after having had the opportunity to examine the type.

Type: — Würtemburg. (The type of *aberrans* is in Br. M.)

Type locality: — For *P. carpenterii*, 48° 31′ N., 10° 03′ E., 690 fms.; for *P. aberrans*, south of New York, in 1700 fms.

Distribution: — Widespread in the northern Atlantic also in the Indo-Pacific.

Depth: — From about 700 to 1700 fms.

Specimens examined: — The type in Br. M.; also a fragment, belonging to Yale University, from "Albatross" Sta. 2231, between Cape Hatteras and Nantucket, 965 fms. depth.

Remarks: — The specimens examined agree completely with Jungersen's description and figures. Judging from the material existing in the various collections, this species seem normally to attain a length of 20–30 cm.

Note: — Other species known from the Atlantic Ocean.

P. thomsonii Kölliker, see Kükenthal, 1915, p. 38. Possibly a geographic variety of *P. carpenterii*. It occurs in the warm area of the Atlantic Ocean and may be expected in the West Indies.

P. denticulatum Jungersen, see Kükenthal, 1915, p. 38. Known only from south of Greenland but may possibly reach the coasts of North America.

(*P. smitti*, Kölliker, see Kükenthal, 1915, p. 39. A doubtful form, taken from deep water in the Northern Atlantic.)

Genus 2. Distichoptilum Verrill 1882

Diagnosis, compiled from Jungersen, 1904, p. 62: — Slender pennatulids with autozooids arranged alternately in simple rows on each side. Calicinal teeth, indistinct to distinct on the abaxial edge, and none on the adaxial edge, which fuses with the rachis. Two siphonozooids for each autozooid, one dorsal and one ventral.

Deep sea, (Atlantic, Indo-Pacific).

Type species: — *Distichoptilum gracile* Verrill.

Remarks: — Only one species is known in the Atlantic Ocean.

Distichoptilum gracile Verrill

Distichoptilum gracile Verrill, 1882a, p. 362. — Jungersen, 1904, pp. 62–65, pl. 1, figs. 12–14 (complete description). — Kükenthal & Broch, 1911, p. 255 (no description). — Broch, 1913, p. 3, text-fig. 1 (?). — Hickson, 1916, p. 102. — Kükenthal, 1915, p. 39 (complete list of references).

? *Distichoptilum gracile* Thomson & Henderson, 1906, p. 87.

Type: — U. S. N. M. cat. no. 11925.

Type locality: — Off Nantucket, in 700 fms. (U. S. Fish Commission).

Distribution: — In the Atlantic Ocean: off Nantucket, off Greenland, south of Iceland, near Gibraltar (?).— In the Pacific Ocean (Thomson & Henderson), and waters off the Malayan Archipelago (Hickson).

Specimens examined: — Fragments of the type (Yale Museum).

Remarks: — Not taken by the "Blake" expedition, but may be expected in the West Indies.

The species is easily recognized by its lateral, strongly appressed calicles with two large teeth and the small siphonozooids between the rachis and the opening of the calicle.

Stachyptilidae Kölliker 1880

Diagnosis: — Slender to strongly inflated seapens with the autozooids strongly appressed and placed in short, oblique rows in close succession. The rigid anthostele is unsymmetrically developed, and with or without strong marginal spines. Siphonozooids present on the dorsal side (except in the midline) and around the base of the autozooids. Spicules as needles or short, bone-like or biscuit-shaped bodies.

Remarks: — The family with its one genus is known from the Indo-Pacific.

In Kükenthal's monograph it is placed next to the Protoptilidae while Hickson is more inclined to place in next to the Pennatulidae. See Kükenthal, 1915, p. 41, and Hickson, 1916, p. 5.

Family 5. CHUNELLIDAE Kükenthal, 1902

See Kükenthal, 1915, p. 43. — Hickson, 1916, p. 105.

Diagnosis: — Slender pennatulids with the autozooids arranged in whorls of two to four individuals and in some cases with solitary autozooids placed between the whorls.

Remarks: — Hickson, 1916, p. 106 has given his reasons for re-uniting the different forms which Kükenthal & Broch have divided into three families. Only one genus is known from the Atlantic Ocean.

Genus 1. Scleroptilum Kölliker, 1880

See Kükenthal & Broch, 1911, p. 267. — Kükenthal, 1915, p. 43. — Hickson, 1916, p. 106.

Diagnosis: — Bilaterally developed seapens, with autozooids placed laterally and ventrally in closely following whorls. Autozooids with broad base and upward bent. Siphonozooids scattered among the autozooids. Axis round. Spicules as three-flanged needles, numerous everywhere.

Type species: — *Scleroptilum grandiflorum* Kölliker.

Remarks: — Only one species is known which occurs widespread in all oceans in deep water.

1. Scleroptilum grandiflorum Kölliker

Scleroptilum grandiflorum Kölliker, 1880, p. 30, pl. 7, fig. 29. — Kükenthal, 1915, p. 43, text-fig. 52.
Scleroptilum gracile Verrill, 1883 (1885 b.), p. 510, pl. 3, fig. 6; 1884, p. 219 (partly as *elegans*).

Verrill's description of *S. gracile* reads.— "A handsome new species from eight inches to a foot high, and slender, with many spiculose, flower-like polyps in a row on the upper half, was dredged in many localities by the "Albatross" in 1467 to 2369 fms, off Cape Hatteras."

Type: — Br. M.; Type of *S. gracile* in U. S. N. M.

Type locality: — South of Japan.

Distribution: — South of Japan, west coast of Central America, east and west of Africa, east coast United States, Indian Ocean.

Depth: — From 564 to 2369 fms.

Specimens examined: — Numerous colonies from off the coast of New England. Also colonies from the Pacific Ocean.

Remarks: — The discrepancy between the descriptions given by the different authors is due to the different conception of what is ventral and dorsal in this species. Kölliker mentions dorsal siphonozooids, Verrill speaks of ventral as also Kükenthal & Broch. No difference could be found between the specimens from the Atlantic and the Pacific Ocean and only a very careful anatomical examination can decide what is dorsal and what is ventral in this slender species.

Family 6. UMBELLULIDAE

Only one genus is known.

Umbellula Cuvier, 1798

See Kükenthal & Broch, 1911, pp. 282–302, 452–454; chart 10, p. 484. — Kükenthal, 1915, p. 47. — Hickson, 1916, p. 116.

Diagnosis: — Bilaterally built seapens with autozooids in whorls on the upper end of the stem, forming a thick cluster. Autozooids large, without calicles. Siphonozooids on stem and crowded at base of autozooids, usually provided with one tentacle. Spicules absent or present, always three-winged. Cosmopolitan; deep water forms.

Type: — *Umbellula encrinus* Linnaeus.

Remarks: — About thirty-two species are listed by Kükenthal & Broch, 1911, with the reservation that some of them may prove to be synonyms. Two species are known off the east coast of North America, and one of these is represented in the "Blake" material from the West Indies. Several other species known from the "warm area" of the Atlantic Ocean may be expected and are listed below.

Key to the species of Umbellula known from the West Indies and the east coast of North America

Autozooids with spicules. Tentacles short, about as long as the robust zooid's body .....
1. *U. güntheri* Kölliker

Autozooids without spicules. Tentacles long, longer than the slender zooid's body .....
2. *U. lindahlii* Kölliker

1. Umbellula güntheri Kölliker

Umbellula güntheri Kölliker, 1880, p. 18, pl. 9, fig. 34. — Kükenthal & Broch, 1911, p. 453. — Broch, 1913, p. 3, pl. 1, fig. 1, text-figs. 2–3. — Kükenthal, 1915, p. 52.
Non *U. güntheri* Agassiz, 1888, ("Blake" Cruise II), p. 142, fig. 449.

Reported from the Atlantic Ocean near the Equator by Kölliker. Later, Verrill reported it from the east coast of North America, in 3160–3710 m. (1884, p. 219; and 1885c, p. 509, pl. 1, figs. 3–3b). The illustrations he gives suggest very much Kölliker's species. No reference is made to the numerous spicules in the zooids.

Type: — Br. M.

Distribution: — Eastern part of the Atlantic; also off the Canaries. Studer's record from the Gulf of Panama seems doubtful (1894, p. 57).

Specimens examined: — Two good colonies from Guadeloupe in 734 fms., "Blake" Sta. 162; M.C.Z. cat. no. 4353.

2. Umbellula lindahlii Kölliker

Umbellula lindahlii, see Kükenthal & Broch, 1911, p. 453. — Jungersen, 1904, p. 75, pl. 3, figs. 37–46 (full description). — Kükenthal, 1915, p. 48.
U. bairdii Verrill, 1884, p. 219; 1885 c, p. 509, pl. 1, figs. 1–2.
U. güntheri Agassiz, 1888, pt. II, p. 142, fig. 449.
Not *U. gracilis* Marshall, as Jungersen suggests, 1904, p. 75. (See Broch, 1913, p. 6).

The "Blake" collection contains two good specimens and a denuded stem. The specimens seem to agree well with Verrill's figures of *U. bairdii* collected off Cape Hatteras in 731–2033 fms., and also with Jungersen's description.

Type: — Probably not existing.

Type locality: — Off coast of Greenland.

Distribution: — Northern Atlantic, West Indies.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Location*	*Specimens*
4366	33	1568	Off Yucatan	1 young
4354	182	1131	" Dominica	1 complete
				1 denuded axis

Also some colonies from "Albatross," Sta. 2097 (Yale Museum).

Remarks: — Jungersen suggests tentatively that Marshall's *U. gracilis* from the west coast of Africa be placed under this species. But Broch (1913, p. 6, pl. 1, figs. 2–3) has examined several specimens collected off the Canaries and considers

gracilis a valid species, characterized by numerous zooids, even in young specimens, rounded axis, and tentacles shorter than the zooid body. The species may be expected in the West Indies.

Note: — Beside the above mentioned species of *Umbellula*, there are a number listed from the eastern part of the Atlantic Ocean (excluding *U. encrinus* L. from the Arctic cold water).

U. crassiflora Roule, 1905, p. 456, see Kükenthal, 1915, p. 56 (he considers it doubtful).

U. thomsoni Kölliker, see Kükenthal, 1915, p. 54.

U. encrinus var. *ambigua* Fischer, see Kükenthal, 1915, p. 49.

U. gracilis Marshall, see Broch, 1913, p. 6, and Kükenthal, 1915, p. 53.

Attempts to arrange the species of this genus into a key have been made by Kükenthal, 1914, p. 630; 1915, p. 48. See also Hickson, 1916 (addition of one new species).

Family 7. VIRGULARIIDAE

See Hickson, 1916, p. 146. Also Kükenthal, 1915, p. 63.

Diagnosis: — Pennatulacea with long and usually slender rachis, with autozooids arranged in perfectly or imperfectly developed leaves with a long series of immature leaves at the proximal end of the rachis. Radial canals developed dorsally. Cosmopolitan, from shallow water to about 500 fms.

Remarks: — A very careful revision of the family is given by Hickson, 1916. It differs in many respects from Kükenthal's account, 1915. Only two genera are now included in the family.

Key to the genera

Leaves supported by huge fans of projecting spicules.....1. *Stylatula* Verrill.
Leaves not supported by large spicules.....2. *Virgularia* Lamarck.

Genus 1. Stylatula Verrill 1864

See Kükenthal, 1915, p. 67.

Diagnosis: — Slender bilaterally built seapens with numerous autozooids of approximately the same number throughout the colony and almost of the same size; a long streak of immature leaves occur at the base of the stem. Leaves supported by a large fan of projecting pointed spicules. Autozoids free or more

or less completely united, with or without spicules. Siphonozooids small, placed between the leaves. Spicules practically absent except in the supporting fan and in some species in the autozooids and the stem.

Type species: — *S. elongata* (Gabb).

Remarks: — Aside from some doubtful species with no locality and possibly merely aberrant colonies of well known species, the genus includes one north Atlantic form, *S. elegans* (Danielssen) which possibly deserves a separate genus, and a number of closely related forms, known from the West Indies, South America and Central America, as far north as California, and mostly occurring in shallow water.

Key to the species of Stylatula known from the western part of the Atlantic Ocean

1. Small colonies with leaves distant and at utmost 6 autozooids, almost free. Spicules in tentacles..... 1. *S. elegans* (Danielssen).
1. Tall colonies with leaves crowded and numerous (15–26) autozooids, at least united at their base..... 2.
2. Mature autozooids well separated in their upper part, and lacking spicules..... 2. *brasiliensis* (Gray).
2. Mature autozooids incompletely separated at their upper ends, and filled with spicules. 3. *S. antillarum* Kölliker.

1. Stylatula elegans (Danielssen)

Virgularia elegans Danielssen, 1860, p. 277.
Stylatula elegans Kükenthal, 1915, p. 68, text-fig. 68 (complete list of references).

A few fragments are present in the "Blake" collections representing a species which hardly can be anything but *S. elegans*.

The fragments measure 3–4 cm. in length with an axis 0.5 mm. wide. The autozooids are arranged in leaves, well separated, about 5 mm. apart, in each leaf three to six, almost free and with long tentacles. The supporting fan consists of about 10 long straight spicules and also a number of smaller spicules. The tentacles contain a larger number of small, three-flanged rods, with the flanges twisted near the middle. Color in alcohol, pale gray, autozooids pale brown. Axis round, white. The large supporting rods measure 1.2–1.5 mm., the tentacle rods about 0.1 mm.

Type: — Possibly in Norway.

Type locality: — Off Molde, Norway, 25–50 meters.

Distribution: — According to Jungersen, from Lofoten to the Danish waters, off the Hebrides and south of Iceland. A record of *Stylatula* spec. Verrill, from

off Chesapeake Bay, 444 fms. may possibly refer to this species. The first authentic record is from off Dry Tortugas, 339 fms. ("Blake" Sta. 43).

Depth: — From 15 to 550 fms.

Specimens examined: — A colony from Norway; fragments from off Dry Tortugas, M.C.Z. cat. no. 4344.

2. Stylatula brasiliensis (Gray)

Lygus brasiliensis Gray, 1870, p. 18.
Stylatula braziliensis Kükenthal, 1915, p. 71 (complete list of references).
Stylatula darwinii Kükenthal, 1915, p. 70 (partim). Nec *S. darwinii* Kölliker, 1872, p. 567.

A tall species with numerous broad leaves with 7–10 large spicules in a fan beneath each leaf and with approximately 15 autozooids which are free in their upper part and lack spicules completely.

Type: — Br. M.

Type locality: — Off Cape Frio, Brazil.

Distribution: — Known from the type locality and vicinity, also from St. Lucia, W. I.

Depth: — From shallow water down to 40 fms.

Specimens examined: — The type, also several colonies from St. Lucia, M.C.Z. cat. nos. 4352, 4357.

Remarks: — The types represent some very poor fragments of the upper part of the colonies with the leaves rather obliquely placed. The colonies from St. Lucia lack the upper part of the colony; they probably measured 50–60 cm. in unbroken condition.

The species is closely related to *S. elongata* (Gabb) from the coast of California. What Kükenthal & Broch, 1911, described as *S.* aff. *darwinii*, from California and coast of Brazil refers probably to these two species. The true *S. darwinii*, from Patagonia, is characterized by having spicules in the autozooids.

3. Stylatula antillarum Kölliker

Stylatula antillarum Kölliker, 1870, p. 588. — Kükenthal, 1915, p. 71 (as a doubtful form).

A tall form with crowded leaves with 7–8 strong spicules in a fan below the leaves; autozooids about 25 in number, very imperfectly separated and filled with numerous spicules in the upper part.

Type: — Paris.

Type locality: — "Antilles."

Distribution: — West Indies.

Depth: — Probably shallow water. Recorded from 484 fms. (Bingham Ex.).

Specimens examined: — One tall, broken colony from north of Glover Reef, Caribbean Sea; Bingham Oceanographic Expedition, Yale University.

Remarks: — The specimen examined agrees in most respects with Kölliker's description. The large number of autozooids, the comparatively low number of supporting spicules and the large spicules in the anthocodia, separate this species from the other species known from the West Indies. The spicules in the autozooids are larger than in the type (0.25 mm.).

S. antillarum is, according to Kölliker, closely related to *S. darwinii* from Patagonia, and possibly also to *S. gracilis* Verrill from off Panama. The differences consist chiefly in a lower number of autozooids and a higher number of supporting spicules in the two last mentioned forms. The spicules in the autozooids range according to Kölliker, from 0.11–0.13 mm. in *S. antillarum*, 0.09–0.11 mm. in *S. darwinii* and 0.15–0.38 mm. in *S. gracilis*. All these differences may prove to be of absolutely no value and in that case the name *S. gracilis* has priority.

Stylatula spec.

Stylatula spec. Verrill, 1885 b, p. 150.

No description. The colony was collected off Chesapeake Bay in 444 fms. Verrill's specimen has not been found in U. S. N. M. but the chances are that it is a specimen of *S. elegans* (Danielssen).

Genus 2. Virgularia Lamarck 1816

For synonyms, etc., see Kükenthal, 1915, p. 71. — Hickson, 1916, p. 148.

Diagnosis: — Slender seapens with comparatively short stalk and a large number of leaves, composed of autozooids of almost equal size. A large number of the leaves on the proximal part of the stem are undeveloped. Spicules usually completely lacking or very sparingly represented in the stalk.

Type species: — *V. mirabilis* (Linnaeus).

Remarks: — By mistake O. F. Müller is usually quoted as the author of this species. The first reference is given by Linnaeus in 1754, p. 96, with a very good description and also a good figure. It was then called *Polypus*

mirabilis and the locality given as "Vesterhavet" (= the North Sea; the latin translation says simply, the Atlantic Sea). In his tenth edition, 1758, p. 819, the name is changed to *Pennatula mirabilis*, Habit in O. Norvegico. Unfortunately Pallas, 1766, p. 370, referred a West Indian form, probably from Porto Bello, to Linnaeus' species. His description suggests a *Scirpearia*, and most unfortunately Linnaeus tried to combine the two descriptions, and his figure in 1776 is very poor.

O. F. Müller included *Pennatula mirabilis* in his Prodromus, 1776, p. 255, and in his large Latin edition of Zoologica Danica, 1888, p. 11, he gave a complete list of references, and, on pl. 11, an excellent figure of the whole colony. When Lamarck in 1816 established the genus *Virgularia* he selected *P. mirabilis* Müller as the type species, without realizing that the species actually was described by Linnaeus. Pallas' *Pennatulla mirabilis* from the West Indies was in the museum in Paris and Lamarck placed it in the genus *Funiculina;* its name was changed to *F. cylindrica*. Wright & Studer, 1889, p. 154, mention that the colony in Paris is a Gorgonid; Toeplitz, 1929, p. 317, regards it as a doubtful *Scirpearia*.

Key to the species of Virgularia known from the Atlantic Ocean

1. Autozooids numerous, about 24 on each leaf..... *V. schultzei* Kükenthal.
1. Autozooids few, at utmost 16 on each leaf.....2.
2. Autozooids 3–6.....3.
2. Autozooids 6–16.....4.
3. From 3–6 autozooids, well separated; anthostele with distinct tubercles. North Atlantic form..... *V. tuberculata* Marshall.
3. Five autozooids are reported; anthostele without distinct tubercles (?). Known from the coast of South America.....2. *V. kophameti* May.
4. Autozooids up to 16, almost free.....1. *V. mirabilis* (Linnaeus).
4. Autozooids 6–10 united in their greater length..... *V. glacialis* Kölliker.

1. Virgularia mirabilis (Linnaeus)

Polypus mirabilis Linnaeus, 1754, p. 96, pl. 1, fig. 4.

Pennatula mirabilis Linnaeus, 1758, p. 819. — O. F. Müller, 1776, p. 255; 1788, p. 11, pl. 11. Nec Pallas, 1766, p. 370.

Virgularia ljungmannii Whiteaves, 1901, p. 33.

Virgularia mirabilis Kükenthal, 1915, p. 73 (complete list of references).

This widespread species has only once been reported from American waters, namely by Whiteaves, 1901, p. 33, who reported 15 colonies from Gulf of St. Lawrence, north east of Cape des Rosiers, at 200 fms., (as *V. ljungmannii*).

Type: — Probably lost.

Type locality: — Off the coast of Norway.

Distribution: — According to Jungersen, 1904, p. 33, it ranges from Lofoten, Norway to the Mediterranean Sea and Azores and has also been collected south of Iceland.

Depth: — From 20 to 200 fms. (At Dröbak, Norway said to have been taken at 5 meters).

Remarks: — Jungersen has given a very complete account of the development of this species. Complete colonies seem to reach a height of more than 50 cm. but it is not known how quickly the full number of autozooids is reached and how great a variation the species exhibits in this respect. Jungersen mentions 12 in each leaf; Kükenthal, 1915, p. 74, says up to 16. It is possible that *V. glacialis*, which according to Grieg, 1891, p. 11, occurs from Bergen to Varanger, Norway, represents specimens of *mirabilis* with up to 10 autozooids in each leaf.

2. Virgularia kophameli May

Virgularia kophameli May, 1899, p. 10. — Kükenthal, 1915, p. 75.

The species is very imperfectly known. Kükenthal & Broch have had occasion to examine the type which seems to be the only specimen existing in any collection. The leaves are described as having 5 autozooids, closely adpressed to the stem, and a single row of siphonozooids between the leaves. A small colony which now is lost was secured by the "Hassler" expedition from near the type locality. According to Verrill's notes it had 8 or more autozooids and the leaves were crowded and overlapped ventrally.

Type: — Hamburg.

Type locality: — East coast of South America, 100 m.

Distribution: — Known only from the type locality and off Coy Inlet, Patagonia, 58 fms.

Depth: — From about 50 fms.

Specimens examined: — None.

Remarks: — The species is so imperfectly known that very little can be said about its affinities to other forms.

Virgularia spec.

Fragments of a tall *Virgularia* are present in U. S. N. M., collected near Corpus Christi, Texas; depth unknown. It has large leaves with about 24 auto-

zooids; the upper part of these is completely withdrawn into the lower more rigid part which are united into a thick fleshy band. Siphonozooids were visible in scattered rows between the leaves. The high number of autozooids suggests *V. schultzei* from off Cape of Good Hope, but the autozooids appear much more free in that species and the row of siphonozooids on the autozooids which also characterizes that form were not discovered. It may of course be that the fragments examined represent immature leaves, partly undeveloped and that the siphonozooids are not developed at this stage.

Virgularia tuberculata Marshall

Cladiscus gracilis Koren & Danielssen, 1877, p. 101, pl. 9, figs. 13–15. Nec *Virgularia gracilis* Gabb, 1863.

Virgularia tuberculata Marshall, 1883, p. 129, pl. 21, figs. 1–3. — Kükenthal, 1915, p. 73, text-figs. 74–75 (complete list of references).

Virgularia cladiscus Jungersen, 1904, p. 33.

The species seems usually to reach a length of 10 cm. Great stress has been laid on the presence of small marginal tubercles on the anthostele, but Jungersen, p. 34, says expressly that they "may be indistinct and seem to be wanting," and Hickson, 1930, p. 224 has made a similar observation in another species so very likely the presence or absence of these tubercles is of no importance.

Type: — Possibly in Norway.

Type locality: — Coast of Norway.

Distribution: — According to Jungersen it has been reported as far south as southwest of Ireland, and as far north as around Spitzbergen and north of Asia. It is common along the coast of Norway and occurs also south of Iceland and seems to have its main distribution within the warm area of the Atlantic.

Depth: — Reported from 40–555 fms.

Specimens examined: — None.

Remarks: — It is very likely that this species occurs in American waters but that it has been overlooked on account of its small size.

Family 8. ANTHOPTILIDAE Kölliker 1880

See Kükenthal, 1915, p. 32. — Hickson, 1916, p. 137.

Diagnosis, from Hickson, 1916, p. 138: — Large pennatulids with a long fleshy rachis with numerous large autozooids arranged singly, in oblique rows, in primitive and usually interrupted leaves or in clusters. Siphonozooids numer-

ous, situated between the leaves, extending on to the dorsal track and in some cases also between the autozooids of a row. Gonads formed in the fully developed autozooids. Radial canals on the dorsal side of the rachis. No spicules developed except occasionally a few in the stalk.

Remarks: — The family consists of one genus with a number of representatives in the Indo-Pacific and Atlantic. Hickson gives good reasons for transfering this family to near the Balticinidae. The presence of dorsal radial canals has only been ascertained in *A. malayense* Hickson.

Genus 1. Anthoptilum Kölliker 1880

Diagnosis: — As for the family.

Type species: — *A. grandiflorum* (Verrill).

Indo-Pacific and Atlantic. Three species are known from the Atlantic Ocean.

Key to the species of Anthoptilum known from the western Atlantic

1. Autozooids tall (30–50 mm.), placed in transverse rows.....3. *A. sertum* (Verrill).
1. Autozooids short (10–12 mm., or less), placed in oblique rows, or scattered.....2.
2. Autozooids arranged in rows, in orderly fashion, the rows are well spaced. Stem thick.... 1. *A. grandiflorum* (Verrill).
2. Autozooids arranged in rows in disorderly fashion. Single zooids are often found between the regular rows. Stem slender.....2. *A. murrayi* Kölliker.

1. Anthoptilum grandiflorum (Verrill)

Virgularia grandiflora Verrill, 1879, p. 239.

Anthoptilum thomsoni Kölliker, 1880, p. 13, pl. 5, figs. 16–18.

Anthoptilum grandiflorum Jungersen, 1917, p. 1193 (complete list of references). — Kükenthal & Broch, 1911, p. 234, and Kükenthal, 1915, p. 32, pro parte; (according to Jungersen the material they examined was *A. murrayi* while their list of literature includes both *A. grandiflorum* and *murrayi*). — Kramp, 1932, p. 11.

The species has been well described by Jungersen, 1904, 1917, who had occasion to study both *A. grandiflorum* and *A. murrayi*. An excellent figure is given by Kölliker, 1880. Kükenthal & Broch's material from the Indian Ocean is now referred to a new species, *A. kükenthali* Hickson.

Type: — Possibly in U. S. N. M.

Type locality: — Off Nova Scotia.

Distribution: — According to Jungersen, 1917, p. 1196, it ranges from Davis Strait to Nova Scotia, the West Indies and as far south as Buenos Aires, Tristan da Cunha and off Cape of Good Hope. It is not reported from any locality in the north eastern part of the Atlantic. There are a few records from the coast of California, Hawaii, Aleutian Islands which need re-investigation. (The material from the Indian Ocean is now referred to a new species *A. kükenthali* Hickson, 1916, p. 142).

Depth: — According to Jungersen, from 85 to probably above 1500 fms.

Specimens examined: — Three specimens collected off Guadeloupe in 734 fms. ("Blake" Sta. 162 and 173), and off New England in 603 fms. ("Blake" Sta. 329); M.C.Z. cat. nos. 4339, 4340, 4347. Also several in U. S. N. M.; the type of *A. thomsoni* in Br. M.

2. Anthoptilum murrayi Kölliker

Anthoptilum murrayi Kölliker, 1880, p. 14, pl. 6, figs. 19–31. — Verrill, 1884, p. 220; 1885, p. 311. — Jungersen, 1904, p. 67; 1917, p. 1193. — Hickson, 1916, p. 140.
Anthoptilum grandiflorum Kükenthal & Broch, 1911, p. 233 (pro parte).

Jungersen insists upon the validity of this species which he has had occasion to examine alive (as well as *A. grandiflorum*) and he feels that even a superficial examination is sufficient to separate the two species. He mentions the almost invariable presence of a parasitic crustacean in *A. grandiflorum* while it never is found in *A. murrayi* and he had occasion to examine 43 colonies of the latter species. He has furthermore had occasion to examine both the type of *A murrayi* and *A. thomsoni* (*A. grandiflorum*) in the British Museum. The colonies from the Indian Ocean which Kükenthal & Broch refer to *grandiflorum*, are now placed in a new species *A. kükenthali* Hickson, 1916.

The differences between the two species which Jungersen and Hickson independently have found are briefly set forth in the key above.

Type: — Br. M.

Type locality: — South of Halifax, Nova Scotia, 1230 fms.

Distribution: — Along the east coast of North America *A. murrayi* seems to occur in the same area as *A. grandiflorum*. It has not been taken in any locality in the Davis Strait but is known from south of Iceland and the Bay of Biscay. It has not yet been reported from the West Indies.

Depth: — From about 600 to 1300 fms.

Specimens examined: — The type in Br. M.; several colonies in U. S. N. M.

Remarks: — Jungersen's last paper, 1917, is published in Danish and it is therefore discussed in such detail. Almost the same conclusions as his are reached by Hickson, 1916, who gives a very clear account of the characters which separate the various species in this difficult genus.

3. Anthoptilum sertum (Verrill)

Benthoptilum sertum Verrill, 1883, p. 510, pl. 2, fig. 4; 1884, p. 219. — Stephens, 1910, p. 19, pl. 1.
B. sp. Marion, 1906 (according to Stephens).
A. sertum Kükenthal & Broch, 1911, p. 240, in text ("distinct from *A. grandiflorum?*").—Kükenthal, 1915, p. 33.

Colony short and broad, without the peculiar S-shaped curve which Jungersen noticed in even the youngest of *A. grandiflorum*. Zooids arranged in transverse rows to the tip. Zooids large (30 mm. in the type, 58 mm. in Stephens' colony, compared to 12 mm. in *A. grandiflorum*).

Type: — U. S. N. M.

Type locality: — Off Cape Hatteras in 843 fms. ("Albatross" Sta. 2115).

Distribution: — Off the east coast of North America, off the coast of Ireland. Reported also off the coasts of Spain and Portugal (undescribed, but figured by Marion, 1906, according to Stephens).

Specimens examined: — The type, in the U. S. N. M.

Remarks: — Viviparous, according to I. A. Thomson, (see Stephens).

Family 9. BALTICINIDAE Gray 1870

Diagnosis: — Tall, whip-like bilateral seapens, with the ventral side more or less swollen and the autozooids more or less distinctly united into leaves, and placed in shorter or longer oblique rows which converge distally. Anthostele with two marginal teeth, sometimes split into two. Siphonozooids scattered among the rows of autozooids and often also on the dorsal side except in the midline. Spicules as needles or short rods, present in the anthostele and usually in the stem of the tentacles, more sparingly in the stalk and stem, not present in the siphonozooids. Very old colonies may lack spicules almost completely and the marginal teeth on the anthostele may be soft and leathery.

Remarks: — Only one genus is known.

Balticina Gray 1870

Syn. *Osteocella* Gray, 1870; *Pavonaria* Kölliker, 1870, etc.[1] See Kükenthal, 1915, p. 60 for other synonyms.

Diagnosis: — As for the family.

Type species: — *Balticina finmarchica* (Sars).

Remarks: — Two, possibly three species are known from the Atlantic Ocean. One of these, the type species, is common in the western Atlantic, the other *B. christii*, is reported with some doubt. (The third species, *B. africana* Studer, collected off the west coast of Africa, may, according to Jungersen, 1904, eventually prove to be identical with the type species).

Key to the species of Balticina known from the Atlantic Ocean

1. Autozooids surrounded by a circular wall; about six autozooids in each row..... *B. africana* (Studer).
1. Autozooids not surrounded by a circular wall.....2.
2. Autozooids in short steep rows not united by a distinct webbing. In young colonies (6 cm.) the autozooids form a crowded band on the ventral side of the stem, with the slightly flattened autozooids more or less upward curved.....*B. christii* (Koren & Danielssen).
2. Autozooids in long rows, not steep, and united by a basal webbing. In young colonies (6 cm.) the autozooids are few and widely spaced but not appressed or upward curved... 1. *B. finmarchica* (Sars).

1. Balticina finmarchica (M. Sars)

B. finmarchica (M. Sars), see Jungersen, 1904, p. 39, pl. 1, figs. 28–29; pl. 2, figs. 33–36. — Kükenthal & Broch, 1911, pp. 307, 455, 480, text-figs. 108–111. — Kükenthal, 1915, p. 62. — Hickson, 1916, p. 135.

[1] A few words may be said about the correct name used for this genus. The name *Pavonaria* was first used by Schweigger in 1820 and is a synonym of *Funiculina quadrangularis* (Pallas); Cuvier used the loose term *Pavonaires* in 1817. *Balticina* Gray 1870 with type species *B. finmarchica* Sars is furthermore older than Kölliker's *Pavonaria* 1870; (Kölliker had access to Gray's proofs so he was able to include Gray's results in his work); the name *Pavonaria* does, however, appear in print in 1869 but without any species attached to it. *Ostcoccll*a 1870 Gray, 1870, with type species *O. cliftoni*, probably from Australia, follows a few pages after *Balticina; O. cliftoni*, of which only the axis is known is somewhat doubtful but the other species referred to *Osteocella, O. scptentrionalis* Gray 1872, is a typical *Balticina*. Although the name *Pavonaria* was obviously preoccupied, both Kükenthal & Broch, and Hickson have persisted in using it instead of *Balticina*.

Kölliker states erroneously, in his diagnosis of *Pavonaria* that there are no radial canals in the stem, but in his description of *P. finmarchica* he mentions the close similarity to the stem in *Halipteris christii*, which has radial canals, and also how the swollen ventral (his dorsal) side is filled with reticulated canals and how several of these open into the longitudinal canals. Due to this error on Kölliker's part Hickson, 1911, pp. 1–15, has re-established *Osteocella*, without having examined any specimen of *Balticina*. Comparison of *B. finmarchica* with *O. septentrionalis* has shown that they are not generically different.

The collection contains three specimens, two old and one young. The largest specimen is 27 cm. long; most of the upper part of the stem is denuded, but about one half of the colony is intact. The stalk is 6 cm. high and slightly bulbous. The fleshy stem carries first a few small autozooids, and then in close comb-shaped rows, obliquely placed, confluent autozooids, the youngest meeting at the midline. The calicles are filled with long spicules and have two long marginal teeth. The large tentacles are not completely contracted. Small, wart-like siphonozooids are scattered as paler spots on the thickened ventral side only. The axis is round.

The color in alcohol is white with bluish shade, and dark brown tentacles.

The spicules agree with the figures given by Kükenthal and Broch.

The young specimen has about three widely distributed autozooids in steep rows but confluent at the base, and with long, deeply cleft calicles. It appears to be a somewhat later stage than the one figured by Jungersen (figs. 33–36).

Type: — Apparently not in existence.

Type locality: — Oxefiord, Norway.

Distribution: — Northern Atlantic Ocean; depth of 60–980 fms. (according to Jungersen).

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4346	307	980	41°29′45″N. 65°47′10″W.	1
4342	309	304	40°11′40″N. 68°22′ W.	1
4343	310	260	39°59′16″N. 70°18′30″W.	1

Remarks: — Jungersen (1904, p. 43) discusses the possibility that Studer's *B. africana* (1878, p. 672) is identical with *B. finmarchica*. See Kükenthal, 1915, p. 61.

Balticina christii (Koren & Danielssen)

Complete list of references in Kükenthal & Broch, 1911, p. 454.—Complete description in Jungersen, 1904, p. 45, pl. 2, figs. 30–32 (as *Halipteris*). See also Kükenthal, 1915, p. 60.

This species is reported from the east coast of North America by Verrill (1879, p. 199; and 1882, p. 309), but, as Jungersen states, "nothing has later been heard about it." It is not mentioned in Verrill's notes nor in the Canadian report (1922).

Jungersen, who regarded the species as belonging to another genus, gives as the distinguishing character the fact that the autozooids are not fused together as in *B. finmarchica*. Young stages may, however, be easily confused.

It is quite possible that Verrill's specimens were merely a young colony of *B. finmarchica*.— The distribution of *B. christii* in the eastern Atlantic corresponds with that of *B. finmarchica*.

Family 10 PENNATULIDAE

See Hickson, 1916, p. 180. Also Kükenthal, 1915, p. 80, (partly under Virgulariidae).

Diagnosis: — Bilaterally symmetrical seapens with well developed leaves. The leaves are usually thin and composed of a single row of autozooids, with short free calicles. The siphonozooids occur on the dorsal track and usually between the leaves as well, but never on the leaves. The leaves bear spicules. The gonads are developed in the fully formed leaves. No radial canals. A well developed axis is always present.

Remarks: — Four genera are referred to the family by Hickson. Two of these, *Leioptilum* and *Scytalium* are Indo-Pacific, the two others are represented in the Atlantic Ocean.

Key to the genera known from the Atlantic Ocean

Long needles in the leaves.....2. *Pennatula* Linnaeus.
Short flat rods or grains in the leaves.....1. *Acanthoptilum* Kölliker.

Genus 1. Acanthoptilum Kölliker 1872

Diagnosis: — Long, slender seapens with triangular, fairly closely set leaves and thin sarcosoma. Leaves supported on the lower side by a fan of calcareous spicules as in *Stylatula* and carrying on the ventral side a single row of four to six long calicles, separated at the tip and supported by projecting spindles. No spicules in the anthocodia. Leaves smaller toward the stalk, and finally only siphonozooids are developed. Siphonozooids dorsally placed in one-two longitudinal rows close to the leaves in the interval between these. Stem with siphonozooid-free band, dorsally and ventrally. No radial canals. A few spicules in the stem. Stalk with spicules, and ending in a bulbous part. Gonads situated in the fully developed leaves.

Type: — *Acanthoptilum pourtalesii* Kölliker.

Two species, both described by Kölliker (1872, p. 571), are known from the east coast of the United States. Four other species are known from the coast of California (Moroff, 1902; Nutting, 1919). See Kükenthal & Broch, 1911, p. 455, and chart 13, p. 489. The genus was originally placed by Kükenthal in the Virgulariidae, but in 1924 he follows Hickson and places it, with *Scytalium*, in the Pennatulidae.

Key to the species of Acanthoptilum known from the West Indies

1. Siphonozooids in two rows on each side. Autozooids, five-six on each leaf with triangular, well defined supporting fan, and calicles indistinctly separated. Spicules in stalk biscuit-shaped . . . . . 1. *Acanthoptilum pourtalesii* Kölliker.
1. Siphonozooids in one row on each side. Autozooids four-five on semi-circular leaves with indistinctly defined fan, and calicles well separated. Long cylindrical rods in the stalk . . 2. *A. agassizii* Kölliker.

1. Acanthoptilum pourtalesii Kölliker

Acanthoptilum pourtalesii Kölliker, 1872, p. 571, pl. 19, figs. 158–169. — Kükenthal & Broch, 1911, p. 455. — Kükenthal, 1915, p. 64.

Type: — Does not seem to be in the M.C.Z.

Type locality: — Off French Reef, in 44 fms. Another specimen from 12–15 fms. off the Marquesas (Pourtalès Gulf Stream Explor. in both cases).

Specimens examined: — None.

2. Acanthoptilum agassizii Kölliker

Acanthoptilum agassizii Kölliker, 1872, p. 572, pl. 18, figs. 156–157. — Kükenthal & Broch, 1911, p. 157. — Kükenthal, 1915, p. 64.

Type: — Does not seem to be in the M.C.Z.

Type locality: — Off Carysfort Reef, Fla., in 35 fms. (Pourtalès Gulf Stream Explor.), 2 specimens.

Distribution: — Known from the type locality and off St. Lucia.

Depth: — About 35–40 fms.

Specimens examined: — A very poor fragment from St. Lucia, 40 fms. M.C.Z. cat. no. 3956.

Genus 2. Pennatula Linnaeus 1758

Diagnosis, from Kükenthal & Broch, 1911, p. 348: — Bilaterally developed seapens having a stem with well developed leaves with one or more rows of auto-

zooids along the ventral side. Autozooids with calicles. Siphonozooids of equal or unequal size, not on the leaves, but in varying arrangement on the stem. Spicules as rod-shaped bodies, absent or present in the tentacles.

Cosmopolitan; deep sea and littoral.

Type species: — *Pennatula phosphorea* Linnaeus.

Remarks: — Four species have been listed from the American side of the Atlantic Ocean, but actually there are only two. From the European side of the Atlantic two other species are listed, with numerous varieties. Another species is known from Davis Strait.

Key to the species of Pennatula known from the American waters

1. Autozooids arranged at the base of the leaves and forming oblique rows on the stem; almost entirely absent from the dorsal side. No spicules in the tentacles ..... 1. *Pennatula grandis* Ehrenberg (and *P. bellissima* Fowler).

1. Autozooids thickly scattered on the dorsal side of the stem, leaving at the most a narrow strip free. Spicules present in the tentacles ..... 2. *P. aculeata* Danielssen (and *P. americana* Moroff).

1. Pennatula grandis Ehrenberg

Pennatula grandis, Ehrenberg, 1834, p. 66. — Kükenthal, 1915, p. 82 (complete list of references).
Pennatula bellissima Fowler, 1882, p. 135, pl. 6. — Stephens, 1910, p. 17. — Kükenthal, 1915, p. 92.
Ptilella borealis Verrill, 1922, p. 9.

Thoroughly described by Sars, Kölliker, Danielssen, Jungersen, Verrill, Fowler.

Type: — Probably lost. Type of *P. bellissima* in Br. M.

Type locality: — West coast of Norway.

Distribution: — Common off Newfoundland, and as far south as Martha's Vineyard; also reported from off the Bahamas (*P. bellissima* Fowler). In the eastern part of the Atlantic known from the coasts of northern Europe.

Depth: — According to Grieg, 1892, p. 10, the species occur in 50–400 fms. in the Norwegian fiords, while in American waters it ranges from 120–1255 fms.

Specimens examined: — Several colonies in the U. S. N. M.; the type of *P. bellissima* in Br. M.

2. Pennatula aculeata Danielssen

Pennatula aculeata, see Kükenthal & Broch, 1911, pp. 378, 458, text-figs. 177, 181; chart 15, p. 491. — Kükenthal, 1915, p. 90. — Non *P. aculeata* Nutting, 1909, p. 688, (off coast of California).
Pennatula americana Moroff, 1902, p. 381. — Kükenthal & Broch, 1911, p. 459.

Type: — Most likely not existing. Type of *P. americana* in Münich.

Type locality: — Off coast of Norway.

Distribution: — In the western part of the Atlantic from Chesapeake Bay to Davis Strait, in 160-1255 fms. In the eastern part, from north of the Azores to the Arctic Ocean.

Specimens examined: —

M.C.Z. Cat. No.	*"Blake" Sta.*	*Depth (fms.)*	*Locality*	*Specimens*
4334	305	810	41°33′15″N. 65°51′25″W.	12, large and small
4325	306	524	41°32′59″N. 65°55′00″W.	29 small
4333	310	260	39°59′16″N. 70°18′30″W.	5 young

Also, numerous specimens from U. S. Fish Commission, collected off Nova Scotia, Martha's Vineyard, etc.; some of these are white or pink (Verrill, 1922, p. 45).

Remarks: — The description of *P. americana* was based upon a small specimen, collected by Packard in 1877, from off Massachusetts. As far as I can see it is merely a young *P. aculeata*, in which the large zooids on the stem are more regularly and sparingly arranged than in the older specimens. (Moroff does not seem to have had any specimens of *P. aculeata* before him). Jungersen expresses the same opinion (1904, p. 14) and in 1915, Kükenthal includes it in *P. aculeata*.

2a. Pennatula aculeata Danielssen var. laxa Verrill

Pennatula aculeata var. *laxa* Verrill, 1922, p. 45, pl. 18, figs. 1–2.,

"Pinnae longer, more slender, and more loosely arranged than usual. In other respects they agree with the ordinary kind." Deeper water, off Nova Scotia, etc.

Remarks: — No specimens have been examined. It is doubtful whether this variety can be maintained.

Note: — Other species from the Atlantic Ocean are

P. phosphorea Linnaeus, with several varieties, see Kükenthal, 1915, pp. 87–89. It has only one kind of siphonozooids and up to twenty autozooids on the leaves. It has never been reported from the western Atlantic.

P. rubra (Ellis), see Kükenthal, 1915, p. 91. It is known from the Mediterranean Sea. It differs from *P. aculeata* in having two teeth on the calicles of the large siphonozooids and these are placed singly at the dorsal edge of the leaves.

P. prolifera Jungersen, 1904, p. 18, pl. 2, figs. 15–24, see Kükenthal 1915, p. 89, fig. 95 (complete list of references). A small species characterized by 2–3 autozooids on the leaves and a single row of dorsal siphonozooids on each side of a naked longitudinal band; multiplies by transversal fission. It was taken in the Davis Strait, in deep water, and may possibly be found further south, in American waters.

Family 11. PTEROEIDIDAE

See Hickson, 1916, p. 116; also Kükenthal, 1915, p. 98.

Diagnosis: — Bilateral seapens with thick, fleshy rachis and stalk, and large and usually thick leaves composed of a large number of small autozooids. Spicules as rods or needles, smooth or three-flanged.

Remarks: — Two of the three genera are found in the Atlantic Ocean.

Key to the genera known from the Atlantic Ocean

Spicules form rays in the leaves. Shallow water forms.....1. *Pteroeides* Herklots.
Spicules form not rays in the leaves. Deep water forms.....2. *Gyrophyllum* Studer.

Genus 1. Pteroeides Herklots 1858

Diagnosis: — Pennatulids with numerous leaves supported by strong needles arranged in fans. No dorsal accessory leaves. Autozooids on ventral edge and surface of leaves. Siphonozooids placed on the lower side of the leaves, sometimes also on the dorsal, — and on the ventral part of the rachis. Spicules never three-winged. Littoral.

Type species: — *Pteroeides griseum* (Bohadsch).

Remarks: — Two Atlantic species, *P. griseum* (Bohadsch), see Kükenthal, 1915, p. 98, eastern Atlantic and Mediterranean; *P. lusitanicum* Broch, 1910, p. 61, see also Kükenthal, 1915, p. 99, Cezimbra, Portugal, no depth reported.

Genus 2. Gyrophyllum Studer 1891

See Hickson 1915, p. 252. Also Kükenthal, 1915, p. 120.

Diagnosis: — Pennatulids with long stalk and short rachis with few thick, fleshy leaves with autozooids in a zigzag row along the edge. Siphonozooids on both sides of the leaves and on the rachis. Spicules three-flanged, shorter or longer rods.

Type species: — *G. hirondellei* Studer.

Remarks: — One species is known from deep water in the eastern and now reported from the western part of the Atlantic; another from the Malayan Archipelago.

Gyrophyllum hirondellei Studer

G. hirondellei Studer, 1891, p. 94; 1901, p. 35, pl. 4, figs. 3–4. — Kükenthal, 1915, p. 120. — Hickson, 1916, p. 253.

This striking species is described and figured by Studer in 1901.

Type: — Monaco.

Type locality: — Off the Azores in 2200 m.

Distribution: — Eastern and western Atlantic in deep water.

Specimens examined: — Two from off Bahamas in the U. S. N. M.

III. LIST OF DREDGING STATIONS WITH THE NAMES OF ALCYONARIA SECURED

The dredgings in 1868–1869, on board U. S. Coast Steamer "Bibb" under L. F. de Pourtalès, off Sombrero Island, Bahia Honda (Cuba), and Florida, contained several Alcyonarians. These dredgings had no number, and the following list has been compiled from the actual labels and the list of stations in the Bull. Mus. Comp. Zoöl., Vol. 6, pt. 1.

Date	*Fms.*	*Locality*	*Species*
May 4, 1868	324	Bahia Honda, Cuba	*Trachymuricea hirta* n. sp. *Plumarella pourtalesii* (Verrill) *Calyptrophora trilepis* (Pourtalès).

Date	*Fms.*	*Locality*	*Species*
Jan. 16, 1869	42	W. of Tortugas	*Thesea citrina* n. sp. *Thesea plana* n. sp. *Trichogorgia viola* n. sp.
Jan. 1869 [1]	63	W. of Tortugas	*Nidalia occidentalis* Gray.
Feb. 17, 1869	125	S. W. of Sand Key	*Eunephthya nigra* (Pourtalès).
Mar. 31, 1869	52	Carysport Reef	*Telesto sanguinea* n. sp.
May 11, 1869	39–40	Conch Reef	*Telesto sanguinea* n. sp.
May 13, 1869	98	Pacific Reef	*Eunephthya nigra* (Pourtalès).
Uncertain date	No depth	Sand Key	*Caligorgia verticillata* (Pallas).
Probably May, 1868	54	Tortugas	*Telesto flavula* n. sp.

The "Hassler" expedition in 1870–1871, in charge of Louis Agassiz, made only a few dredgings in the western part of the Atlantic Ocean. At two stations Alcyonarians were brought to the surface.

Dec. 29, 1871	100	Off Barbados	*Caliacis nutans* (Duchassaing & Michelotti. *Acanthogorgia aspera* Pourtalès. *Riisea paniculata* Duchassaing & Michelotti. *Chrysogorgia desbonni* Duchassaing & Michellotti var. *thyrsiformis*.
Jan. 18, 1871	200	North of Bahia, off the Abrolhos, Brazil	*Thesea bicolor* sp. nov.

The dredgings made by the "Bache" in 1872 under W. Simpson, have never been published. Alcyonarians were secured at the following localities.

Unknown	270	Off Havana	*Acanthogorgia aspera* Pourtalès.
"	125	" Cuba	*Thesea solitaria* (Pourtalès).
"	126	" Sombrero Island	*Thesea solitaria* (Pourtalès).
"	152	" Florida	*Thesea solitaria* (Pourtalès).
"	120	" Sand Key	*Thesea solitaria* (Pourtalès).
"	174	" Tennessee Reef	*Thesea solitaria* (Pourtalès).

[1] Exact day uncertain; no depth with that number of fathoms is found in the printed list.

Dredging stations of the U. S. Coast Survey steamer "Blake" 1877–79, in charge of Alexander Agassiz; from December to March (no date is given for individual dredgings).

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
25	635	40°5	Off Bahia Honda	*Lepidisis longiflora* Verrill.
29	955	39°5	24°36′N; 84°5′W.	*Acanella eburnea* (Pourtalès).
33	1400–1568	40°5	North of Yucatan Bank	*Umbellula lindahlii* Kölliker.
41	860	39°5	North west of Cuba	*Stenella imbricata* (Johnson), *Scirpearia funiculina* Duchassaing & Michelotti.
44	539	39.5	Northwest of Dry Tortugas	*Swiftia koreni* (Wright & Studer) *Chrysogorgia elegans* (Verrill), *Acanella eburnea* (Pourtalés).
45	101	61°75	Off Dry Tortugas	*Seleraeis guadalupensis* (Duchassaing & Michelotti). *S. petrosa* Verrill, *Thesea solitaria* (Pourtalès), *T. grandiflora* Verrill, *Villogorgia nigrescens* (Duchassaing & Michelotti), *Placogorgia mirabilis* Verrill, *P. tenuis* (Verrill), *Echinomuricea atlantica* (Johnson), *Scirpearia funiculina* (Duchassaing & Michelotti), *Primnoisis humilis* n. sp.
56	175	Not given	22°9′N, 82°21′W. Off Havana	*Thouarella goësii* Aurivillius
101	175–250	69°	Off Morro Light	*Scleraeis guadalupensis* (Duchassaing & Michelotti) *S. petrosa* n. sp., *Chrysogorgia desbonni* Duchassaing & Michelotti.
124	580	42°75	Off St. Croix	*Narella pauciflora* n. sp., *Metallogorgia splendens* (Verrill)
127	38	76°75	Off Santa Croix	*Nidalia occidentalis* Gray, *Diodogorgia nodulifera* (Hargitt & Rogers), *Swiftia exserta* (Ellis & Solander).

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
128	180	60°25	Off St. Croix	*Nicella obesa* n. sp.
131	580	42°75	" "	*Paramuricea echinata* n. sp. *Lepidisis longiflora* Verrill, *Stenella imbricata* (Johnson),
132	117	65	" "	*Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizi* Verrill, *Villogorgia nigrescens* (Duchassaing & Michelotti), *Scirpearia atlantica* Toeplitz, *Scirpearia barbadensis* (Duchassaing & Michelotti), *Nicella guadalupensis* (Duchassaing & Michelotti).
134	248	54°5	" "	*Scleracis guadalupensis* (Duchassaing & Michelotti, *S. petrosa* n. sp., *Scirpearia barbadensis* (Duchassaing & Michelotti).
135	450	42°5	" "	*Funiculina quadrangularis* (Pallas).
155	88	69°	Off Montserrat	*Nidalia occidentalis* Gray, *Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizii* n. sp., *Diodogorgia nodulifera* (Hargitt & Rogers), *Hypnogorgia pendula* (Duchassaing & Michelotti), *Scleracis guadalupensis* (Duchassaing & Michelotti, *Thesea grandiflora* n. sp. *T, grandiflora* var. *rugulosa* n. var., *Bebryce grandis* Verrill, *Acanthacis scabra* n. spec., *Placogorgia tenuis* (Verrill), *Swiftia exserta* (Ellis & Solander), *Caligorgia gracilis* (M.-Edwards), *Scirpearia elongata* (Pallas), *Riisea paniculata* (Duchassaing & Michelotti).

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
157	120	Not given	Off Montserrat	*Nidalia rigida* Verrill, *Thesea hebes* n. sp., *Nicella guadalupensis* Duchassaing & Michelotti.
159	196	53°75	Off Guadeloupe	*Thesea nivea* n. sp.
160	393	43°5	" "	*Swiftia koreni* (Wright & Studer).
162	734	40°	" "	*Umbellula lindahlii* Kölliker, *Anthoptilum grandiflorum* (Verrill).
163	769-878	39°75	" "	*Scleracis guadalupensis* (Duchassaing & Michelotti), *Funiculina quadrangularis* (Pallas).
166	150	59°75	" "	*Scleracis guadalupensis* (Duchassaing & Michelotti), *Thesea hebes* n. sp., *Trachymuricea hirta* (Pourtalès), *Nicella obesa* n. sp.
171	183	55°5	" "	*Echinomuricea atlantica* (Johnson).
173	734	40°	" "	*Clavularia bathybius* (Saville Kent), *Anthoptilum grandiflorum* (Verrill).
174	878	39°75	" "	*S. petrosa* n. sp.
176	391	43°5	Off Dominica	*Trachymuricea hirta* (Pourtalès), *Acanella eburnea* (Pourtalès).
177	118	65°	" "	*Thesea gracilis* n. sp., *T. parviflora* n. sp.
182	1131	39°5	" "	*Umbellula lindahlii* Kölliker.
190	542	42°	" "	*Anthomastus agassizii* Verrill, *Chrysogorgia fewkesi* Verrill, *C. fewkesi* var. *multiflora* n. var., *C. elegans* (Verrill), *Iridogorgia pourtalesii* Verrill, *Lepidisis longiflora* Verrill.
195	502	41°	Off Martinique	*Chrysogorgia fewkesi* Verrill.
200	472	41°5	" "	*Chrysogorgia elegans* (Verrill).

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
203	96	61°	Off Martinique	*Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizii* n. sp., *Hypnogorgia pendula* Duchassaing & Michelotti, *Seleracis guadalupensis* (Duchassaing & Michelotti). *Villogorgia nigrescens* (Duchassaing & Michelotti), *Swiftia exserta* (Ellis & Solander), *Seirpearia atlantica* Toeplitz, *Nicella guadalupensis* (Duchassaing & Michelotti), *Chrysogorgia desbonni* Duchassaing & Michelotti.
205	334	45°5	" "	*Chrysogorgia elegans* (Verrill), *Ceratoisis simplex* (Verrill).
206	170	49°		*Seleracis guadalupensis* (Duchassaing & Michelotti).
208	213	50°	" "	*Caligorgia verticillata* (Pallas).
210	191	Not given	" "	*Seleracis guadalupensis* (Duchassaing & Michelotti).
216	153–154	54°5	" St. Lucia	*Neospongodes agassizii* n. sp.
220	116	58°5	" "	*Plaeogorgia tenuis* (Verrill), *Caligorgia gracilis* (M.-Edwards).
224	114	57°	" St. Vincent	*Acanthogorgia aspera* (Pourtalès), *Caligorgia gracilis* (M.-Edwards), *Chrysogorgia desbonni* Duchassaing & Michelotti.
226	424	42°5	" "	*Chrysogorgia fewkesi* Verrill, *Anthomastus grandiflorus* Verrill.
227	573	40°5	" "	*Stenella imbricata* (Johnson), *S. paueiflora*, Verrill, *Chrysogorgia fewkesi* Verrill.
230	464	41°5	" "	*Iridogorgia pourtalesii* Verrill.

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
231	95	61°5	Off St. Vincent	*Nidalia occidentalis* Gray, *Neospongodes agassizii* n. sp., *Keroides richardii* (Lamouroux), *Scleracis guadalupensis* (Duchassaing & Michelotti), *Bebryce cinerea* Verrill, *Swiftia exserta* (Ellis & Solander), *Seirpearia atlantica* Toeplitz, *Nicella obesa* n. sp., *N. guadalupensis* (Duchassaing & Michelotti).
232	88	62°	" "	*Thesea hebes* sp. nov., *Villogorgia nigrescens* Duchassaing & Michelotti, *Echinomuricea atlantica* (Johnson), *Narella regularis* (Duchassaing & Michelotti), *Chrysogorgia desbonni*, Duchassaing & Michelotti.
233	174	49°5	" "	*Narella regularis* (Duchassaing & Michelotti).
238	127	56°	" Grenadines	*Chrysogorgia desbonni* Duchassaing & Michelotti.
240	164	52°75	" "	*Acanthogorgia schrammi* (Duchassaing & Michelotti).
241	163	53°	" "	*Neospongodes agassizii* Verrill, *Scleraeis guadalupensis* (Duchassaing & Michelotti), *Thesea granulosa* n. sp., *T. rubra* n. sp., *T. rugosa* n. sp., *Acanthacis austera* n. sp., *Placogorgia tenuis* (Verrill), *Echinomuricea atlantica* (Johnson), *Caligorgia gracilis* (Milne-Edwards), *Chrysogorgia desbonni* Duchassaing & Michelotti.
242	842	39°5	" "	*Ceratoisis ornata* Verrill.

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
243	171	51°5	Off Grenadines	*Neospongodes portoricensis* (Hargitt & Rogers).
246	154	56°	" Grenada	*Scleracis guadalupensis* (Duchassaing & Michelotti).
247	170	53°5	" "	*Nidalia occidentalis* Gray, *Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizii* n. sp., *Scleracis guadalupensis* (Duchassaing & Michelotti), *Nicella guadalupensis* (Duchassaing & Michelotti).
249	262	47°	" "	*Thesea granulosa* n. sp., *T. rubra* n. sp., *Villogorgia nigrescens* Duchassaing & Michelotti, *Acanthacis austera* n. sp., *Paramuricea multispina* n. sp., *Scirpearia barbadensis* (Duchassaing & Michelotti), *Riisea paniculata* Duchassaing & Michelotti.
253	92	58°5	" "	*Thesea rubra* n. sp., *T. grandiflora*, n. sp., *Scirpearia barbadensis* (Duchassaing & Michelotti).
254	164	57°	" "	*Echinomuricea atlantica* (Johnson).
256	370	44°5	" "	*Swiftia koreni* (Wright & Studer).
259	159	53°5	" "	*Chrysogorgia desbonni* Duchassaing & Michelotti, *Iridogorgia pourtalesii* Verrill.
262	92	62°	" "	*Nidalia occidentalis* Gray, *Placogorgia tenuis* (Verrill).
263	159	53°5	" "	*Thesea rubra* n. sp.
265	576	39°75	" "	*Anthomastus agassizii* Verrill.
266	461	41°5	" "	*Swiftia koreni* (Wright & Studer).

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
268	955	39°5	Off Grenada	*Stenella imbricata* (Johnson).
269	124	57°5	" "	*Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizii* n. sp., *Echinomuricea atlantica* (Johnson), *Caligorgia verticillata* (Pallas), *Scirpearia funiculina* (Duchassaing & Michelotti), *Riisea paniculata* Duchassaing & Michelotti, *Chrysogorgia desbonni* Duchassaing & Michelotti.
271	458	41°5	" Bequia	*Neospongodes portoricensis* (Hargitt & Rogers), *Thesca rubra* n. sp., *Echinomuricea atlantica* (Johnson).
272	76	64°75	" Barbados	*Nidalia occidentalis* Gray, *Neospongodes agassizii* n. sp., *Scleracis guadalupensis* (Duchassaing & Michelotti), *S. petrosa* n. sp., *Placogorgia tenuis* (Verrill,) *Acanthogorgia schrammi* (Duchassaing & Michelotti), *Caligorgia gracilis* (Milne-Edwards), *Scirpearia atlantica* Toeplitz, *Riisea paniculata* Duchassaing & Michelotti.
273	103	59°5	" "	*Neospongodes agassizii* n. sp., *Scleracis guadalupensis* (Duchassaing & Michelotti), *Bebryce cinerea* n. sp., *Villogorgia nigrescens* Duchassaing & Michelotti, *Echinomuricea atlantica* (Johnson), *Nicella guadalupensis* (Duchassaing & Michelotti), *Chrysogorgia desbonni* Duchassaing & Michelotti.

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
276	94	61°	Off Barbados	*Nidalia occidentalis* Gray, *Neospongodes portoricensis* (Hargitt & Rogers), *Caliacis nutans* (Duchassaing & Michelotti), *Scleracis guadalupensis* (Duchassaing & Michelotti), *Bebryce cinerea* n. sp., *Placogorgia tenuis* (Verrill), *P. rudis* n. sp., *Acanthogorgia schrammi* (Duchassaing & Michelotti), *Caligorgia gracilis* (Milne-Edwards), *Scirpearia atlantica* Toeplitz, *S. funiculina* (Duchassaing & Michelotti), *S. elongata* (Pallas), *Riisea paniculata* Duchassaing & Michelotti.
277	106	58°	" "	*Neospongodes agassizii* n. sp., *Bebryce cinerea* n. sp., *Echinomuricea atlantica* (Johnson), *Nicella guadalupensis* Duchassaing & Michelotti), *Riisea paniculata* Duchassaing & Michelotti.
278	69	68°	" "	*Cyathopodium elegans* n. sp., *Neospongodes agassizi* n. sp., *Scirpearia atlantica* Toeplitz, *S. elongata* (Pallas).
281	288	46°5	" "	*Caligorgia verticillata* (Pallas), *Chrysogorgia desbonni* Duchassaing & Michelotti.
282	154	56°	" "	*Bebryce grandis* n. sp.
283	236	49°	" "	*Chrysogorgia elegans* (Verrill), *C. squamata* (Verrill).
285	13–40	Not given	" "	*Pterogorgia antillarum* Bielchowsky.
286	7–45	Not given	" "	*Scirpearia elongata* (Pallas).
288	399	44°5	" "	*Acanthogorgia aspera* Pourtalès, *Ceratoisis simplex* Verrill.

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
290	73	70°75	Off Barbados	*Alcyonium rubistella* n. sp., *Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizii* n. sp., *Keroides richardii* (Lamouroux), *Hypnogorgia pendula* Duchassaing & Michelotti, *Villogorgia nigrescens* Duchassaing & Michelotti, *Acanthogorgia aspera* Pourtalès, *Caligorgia graeilis* (Milne-Edwards).
292	56	74°5	" "	*Alcyonium rubistella* n. sp., *Neospongodes portoricensis* (Hargitt & Rogers), *Scleracis guadalupensis* (Duchassaing & Michelotti), *Villogorgia nigrescens* Duchassaing & Michelotti, *Placogorgia tenuis* (Verrill), *Caligorgia gracilis* (Milne-Edwards), *Scirpearia atlantica* Toeplitz.
293	82	64°5	" "	*Cyathopodium elegans* n. sp., *Alcyonium rubistella* n. sp., *Neospongodes portoricensis* (Hargitt & Rogers), *Bebryce cinerea* n. sp., *Caligorgia gracilis* (Milne-Edwards).
295	180	50°75	" "	*Echinomuricea atlantica* (Johnson).
296	84	61°5	" "	*Neospongodes portoricensis* (Hargitt & Rogers), *N. agassizii* n. sp., *Villogorgia nigrescens* Duchassaing & Michelotti, *Paramuricea multispina* n. sp., *Caligorgia gracilis* (Milne-Edwards), *Scirpearia elongata* (Pallas), *Chrysogorgia desbonni* Duchassaing & Michelotti.

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
297	123	56°5	Off Barbados	*Alcyonium rubistellum* n. sp., *Neospongodes portoricensis* (Hargitt & Rogers), *Scirpearia barbadensis* (Duchassaing & Michelotti), *Riisea paniculata* (Duchassaing & Michelotti).
298	120	61°	" "	*Neospongodes portoricensis* (Hargitt & Rogers), *Echinomuricea atlantica* (Johnson), *Riisea paniculata* Duchassaing & Michelotti.
299	123	56°5	" "	*Echinomuricea atlantica* (Johnson), *Chrysogorgia desbonni* Duchassaing & Michelotti.

"Blake" 1880, February to May in the western Carribbean, between Cuba, Jamaica, and Honduras.

V	288	55°25	Off Santiago de Cuba	*Acanella eburnea* (Pourtalès).
VII	610	41°	S. of Jamaica	*Acanella eburnea* (Pourtalès).
VIII	322	52°	S. of Jamaica	*Acanella eburnea* (Pourtalès).
XVII	41	79°	Off Honduras	*Scirpearia atlantica* Toeplitz, *S. elongata* (Pallas).
XVIII	600	40°5	S. of Chinchorro Bank	*Acanella eburnea* (Pourtalès).
XXII	250	79°	E. of Cape Cruz, Cuba	*Acanella eburnea* (Pourtalès).
XXV	635		23°04′N., 83°12′W.	*Ceratoisis simplex* Verrill.

"Blake," 1880, summer.

		F.		
305	810	39°	41°33′15″ N., 65°51′25″W.	*Pennatula aculeata* Danielssen.
306	524	39°5	41°32′50″N., 65°55′00″W.	*Acanella arbuscula* (Johnson), *Pennatula aculeata* Danielssen.
307	980	38°	41°29′45″N., 65°47′10″W.	*Acanella arbuscula* (Johnson).
308	1242	38°	Off Georges Bank	*Chrysogorgia agassizii* Verrill, *Acanella arbuscula* (Johnson).
309	304	40°5	" " "	*Acanthogorgia armata* Verrill, *Acanella arbuscula* (Johnson), *Balticina finmarchica* (M. Sars).

Sta. No.	*Fms.*	*Temp.*	*Locality*	*Species*
310	260	42°	39°59′16″N., 70°18′30″W.	*Balticina finmarchica* (M. Sars) *Pennatula aculeata* Danielssen.
318	337	47°	31°48′50″N., 77°51′50″W. Off Carolina	*Eunicella modesta* Verrill, *Swiftia casta* Verrill.
329	603	39°75	" Cape May	*Anthomastus grandiflorus* Verrill.
339	1186	30°	" Delaware	*Anthomastus grandiflorus* Verrill, *Eunephthya fructicosa* (M. Sars).

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[1] The bibliography of the Alcyonarians has been so thoroughly compiled by KÜKENTHAL (1919 and 1924), that repetition of references here is unnecessary. Whenever possible throughout the present volume, citation has been made of these two papers, which contain complete lists of references for each species. The following list covers only the papers which it has been necessary to quote directly, and those dealing with West Indian corals published since 1924. VERRILL'S papers, however, have been quoted in all cases, as they have often been inadequately cited.

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EXPLANATION OF THE PLATES

PLATE 1

PLATE 1

STOLONIFERA, TELESTACEA, ALCYONACEA

Fig. 1. *Clavularia bathybius* (Saville Kent).
Fig. 2. *Alcyonium rubistella* sp. nov.; type.
Fig. 3. *Telesto sanguinea* sp. nov.; type.
Fig. 4. *Telesto flavula* sp. nov.; type.
Fig. 5. *Nidalia occidentalis* Gray.
Fig. 6. *Eunephthya fructicosa* (M. Sars).
Fig. 7. *Eunephthya nigra* (Pourtalès); type.
Fig. 8. *Anthomastus grandiflorus* Verrill; young colony.
Fig. 9. *Anthomastus grandiflorus* Verrill; old colony.
Fig. 10. *Neospongodes portoricensis* (Hargitt & Rogers).
Fig. 11. *Neospongodes agassizii* sp. nov.; type.
Fig. 12. *Neospongodes agassizii* sp. nov.; young colony.
Fig. 13. *Neospongodes caribaea* sp. nov.; type.
Fig. 14. *Neospongodes caribaea* sp. nov.?, young, or *N. agassizii*.

Scale represents 1 cm.

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PLATE 2

PLATE 2

STOLONIFERA, TELESTACEA

Cyathopodium elegans sp. nov.; type.

Fig. 1. Spicules from collaret and operculum.
Fig. 2–3. Spicules from bodywall.
Fig. 4. Perforated horny membrane from inner covering.

Clavularia bathybius (Saville Kent).

Fig. 5–6. Spicules from bodywall.
Fig. 7–8. Spicules from tentacles.

Telesto sanguinea sp. nov.; type.

Fig. 9–12. Spicules from bodywall.

Telesto flavula sp. nov.; type.

Fig. 13–14. Spicules from tentacles.
Fig. 15–16. Spicules from bodywall.

Telesto riisei (Duchassaing & Michelotti).

Fig. 17–18. Spicules from bodywall.
Fig. 19. Spicules from tentacles.

Telesto fruticulosa Dana.

Fig. 20–22. Spicules from bodywall.

Large magnification, except 5–8; scale represents 0.01 mm.

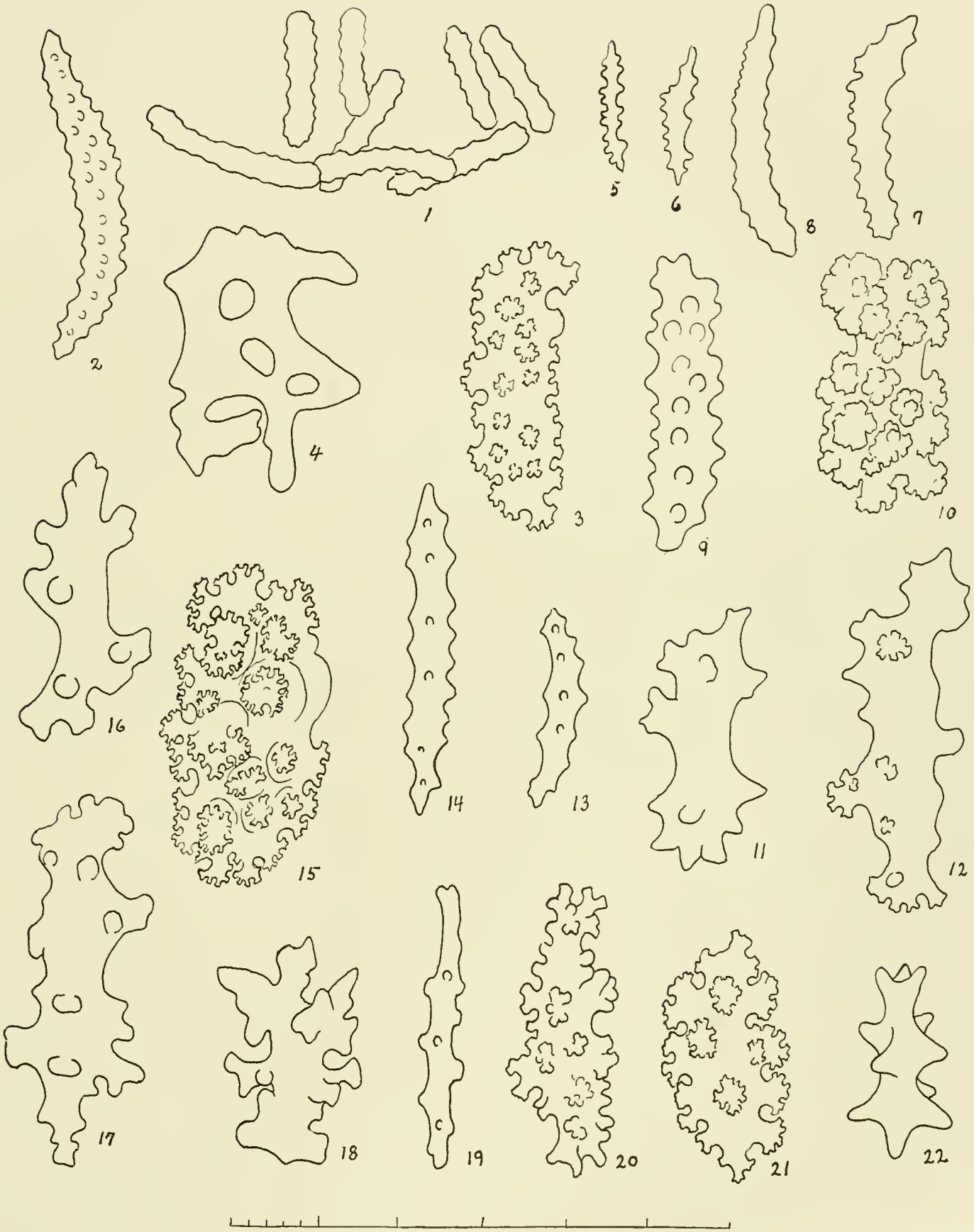
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PLATE 3

PLATE 3

ALCYONACEA

Alcyonium rubistella sp. nov.; type.

Fig. 1–4. Spindles from bodywall.

Fig. 5–7. Double rods or stars from the lower part of the bodywall.

Anthomastus grandiflorus Verrill.

Fig. 8. Spicule from the tentaele.

Fig. 9–12. Double maltesian crosses from disk and autozooids.

Fig. 13. Rod from disk.

Anthomastus agassizii sp. nov.; type.

Fig. 14–15. Rods from disk.

Fig. 16–20. Double crosses from disk and autozooids.

Anthomastus agassizii sp. nov.; young colony.

Fig. 21. Rod from tentaele.

Fig. 22–23. Rods from disk or stem.

Fig. 24–25. Double crosses.

Large magnification; scale represents 0.01 mm.

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PLATE 4

PLATE 4

ALCYONACEA

Nidalia occidentalis Gray.

Fig. 1. Spicules from operculum.
Fig. 2. Flat scale from the introvert.
Fig. 3. Small rod from bodywall.

Nidalia rigida sp. nov.

Fig. 4. Spindle from bodywall (low magnification).

Eunephthya nigra (Pourtalès).

Fig. 5–7. Foliated clubs from wall of zooids.
Fig. 8. Simple warted rod from zooid.
Fig. 9–10. Clubs from stem.
Fig. 11–13. Flat rods from tentacles.

Eunephthya fructicosa (M. Sars).

Fig. 14–17. Spicules from bodywall.
Fig. 18–20. Spicules from zooids.

Eunephthya rubiformis (Ehrenberg).

Fig. 21–23. Spicules from zooids.
Fig. 24–25. Spicules from bodywall.

Large magnification, except fig. 4; scale represents 0.01 mm.

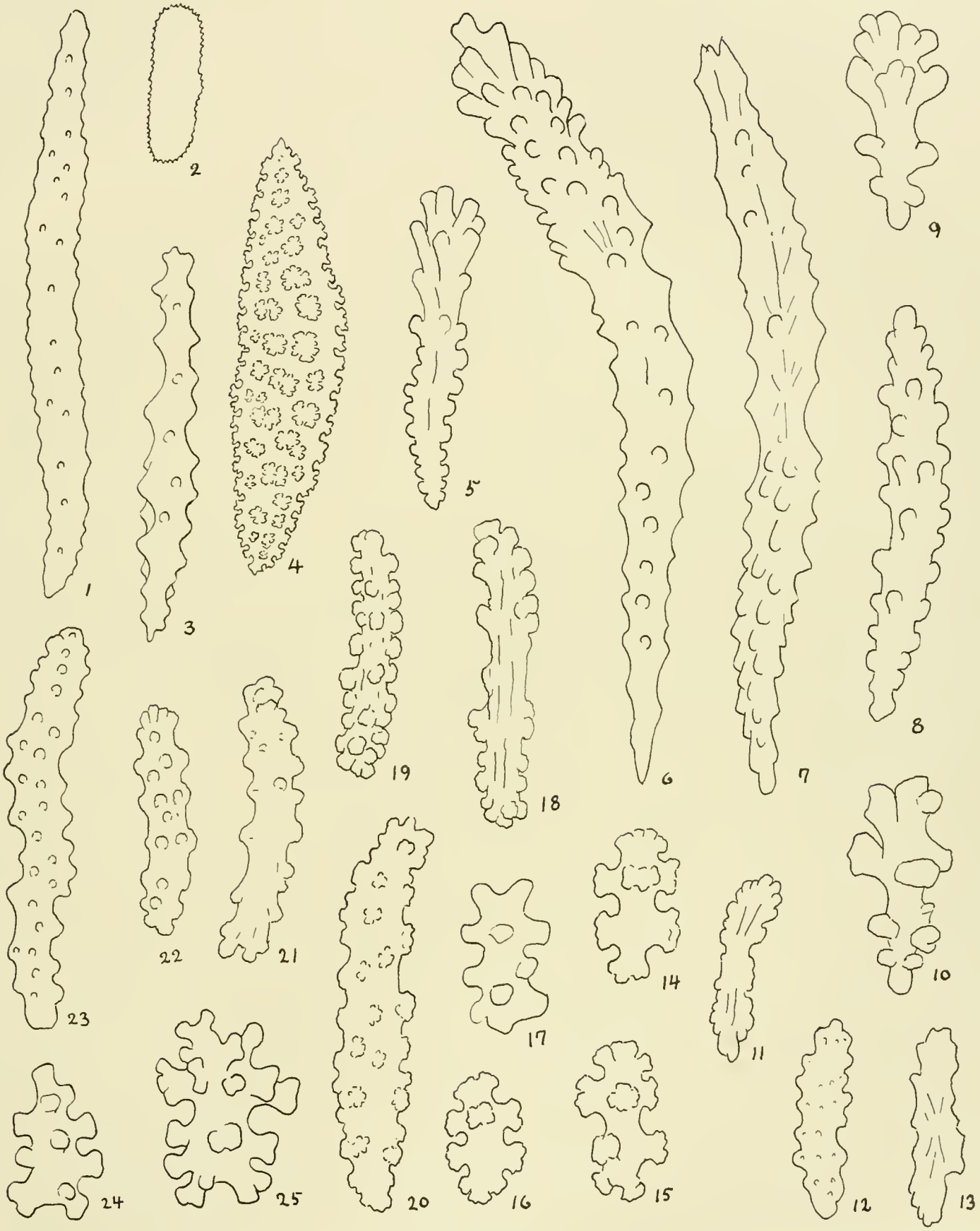
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PLATE 5

PLATE 5

GORGONACEA, BRIAREIDAE

Briareum asbestinum (Pallas).

Fig. 1. Part of large, irregular spicule from inner layer.
Fig. 2. Part of simple spindle from outer layer.

Iciligorgia schrammi Duchassaing.

Fig. 3–4. Rods from outer layer.
Fig. 5. Rod from inner layer.

Titanideum suberosum (Ellis & Solander).

Fig. 6–10. Spicules from outer and inner layer.

Diodogorgia nodulifera (Hargitt & Rogers).

Fig. 11–18. Rods and stars from bodywall and zooids.
Fig. 19. Rod from tentacle.

Paragorgia arborea (Linnaeus).

Fig. 20–22. Short rods and double crosses.

Erythropodium polyanthes (Duchassaing & Michelotti).

Fig. 23. Part of a large rod from the outer layer.

Large magnification; scale represents 0.01 mm.

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PLATE 6

PLATE 6

MURICEIDAE

Fig. 1. *Muricea muricata* (Pallas); branchlet.
Fig. 2. *Caliacis nutans* (Duchassaing & Michelotti).
Fig. 3. *Hypnogorgia pendula* Duchassaing & Michelotti.
Fig. 4. *Placogorgia mirabilis* sp. nov.
Fig. 5–7. *Scleracis guadalupensis* (Duchassaing & Michelotti): pink, red and white varieties.
Fig. 8. *Scleracis petrosa* sp. nov.

Scale represents 1 cm.

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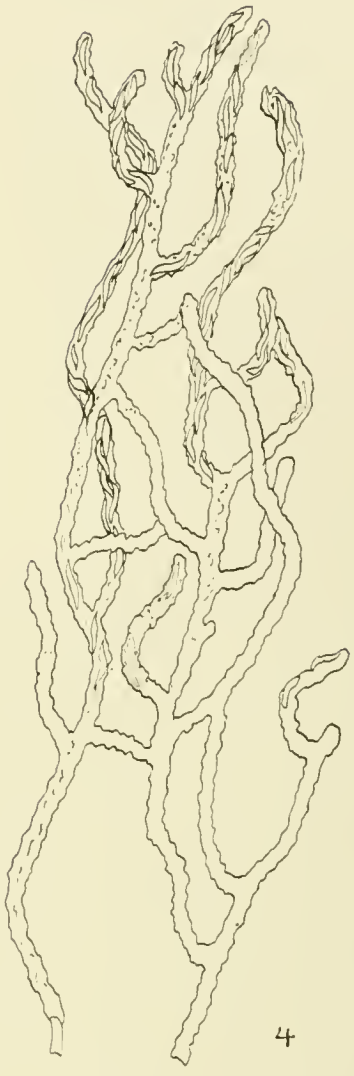

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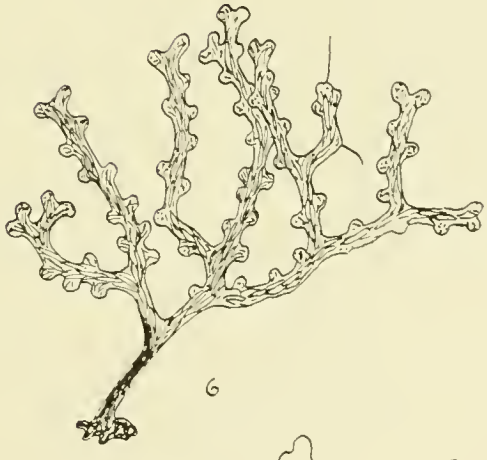

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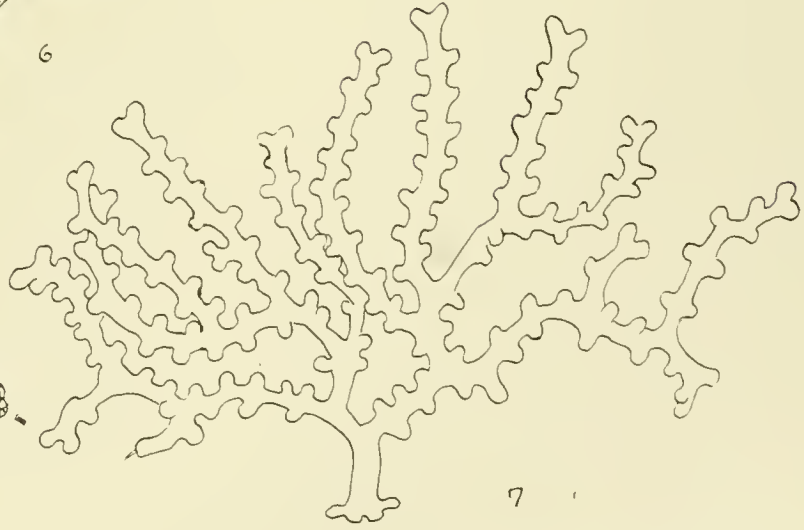

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PLATE 7

PLATE 7

MURICEIDAE

Fig. 1. *Thesea rugosa* sp. nov.
Fig. 2. *Thesea parviflora* sp. nov.
Fig. 3. *Thesea guadalupensis* (Duchassaing & Michelotti).
Fig. 4. *Thesea rubra* sp. nov.
Fig. 5. *Thesea granulosa* sp. nov.
Fig. 6. *Thesea solitaria* (Pourtalès).
Fig. 7. *Thesea nivea* sp. nov.

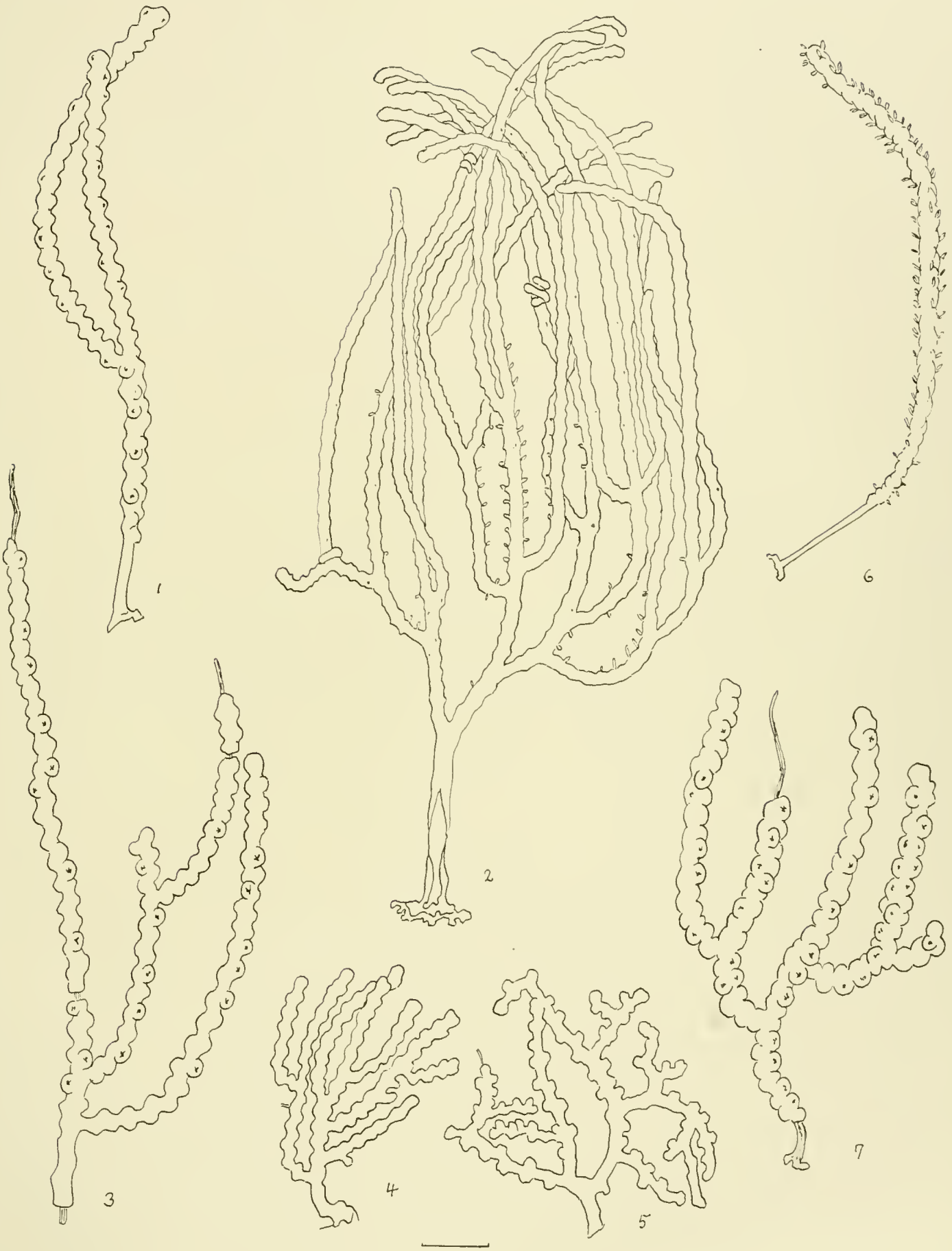
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PLATE 8

PLATE 8

MURICEIDAE

Fig. 1. *Acanthacis scabra* sp. nov.
Fig. 2. *Acanthacis austera* sp. nov.
Fig. 3. *Bebryce grandis* sp. nov.
Fig. 4. *Bebryce parastellata* sp. nov.
Fig. 5. *Bebryce cinerea* sp. nov.

Scale represents 1 cm.

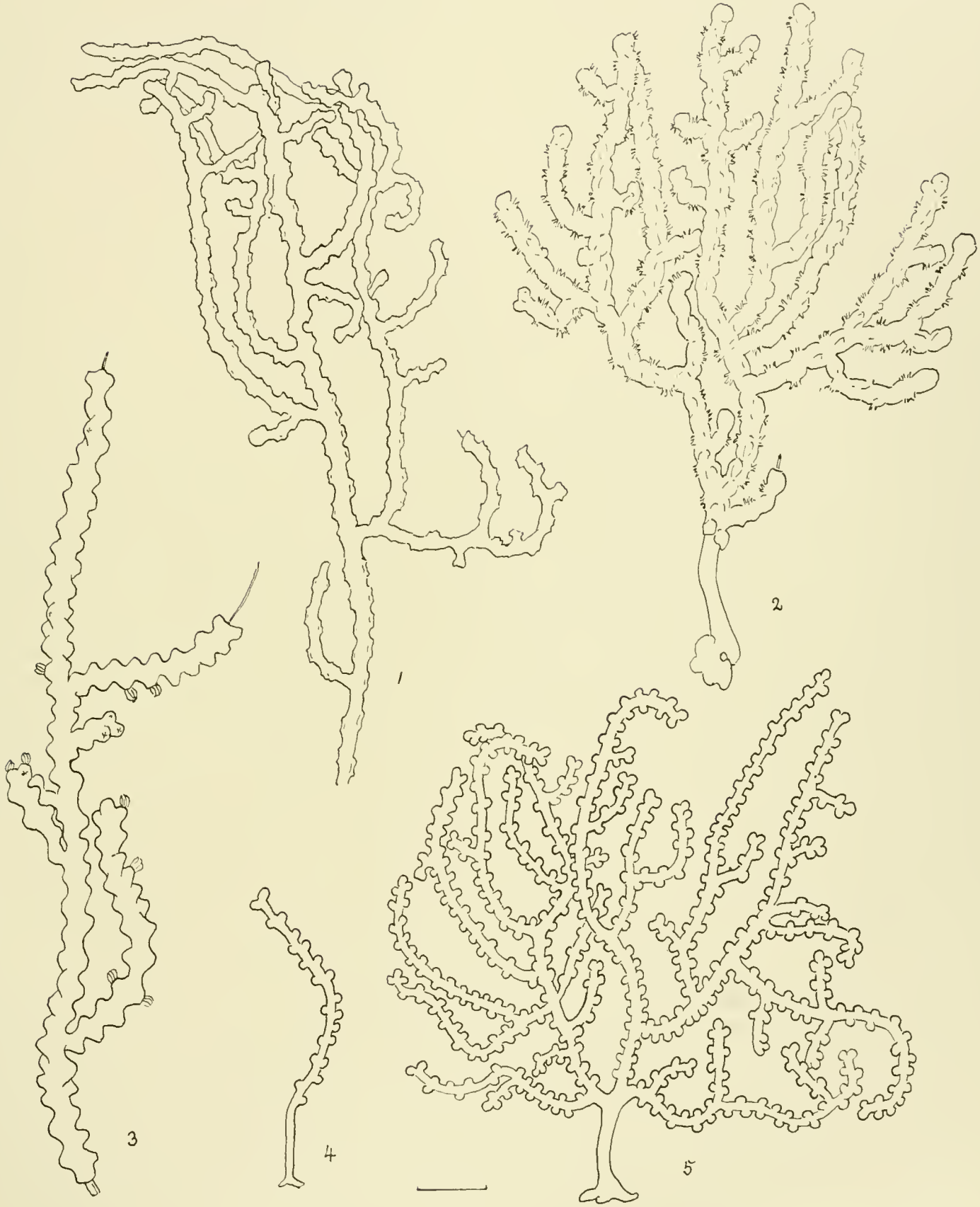
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PLATE 9

PLATE 9

MURICEIDAE

Muricea muricata (Pallas).

Fig. 1. Large spindle from lower lip.
Fig. 2–3. Slender spicule from inner layer of coenenchyma.

Muricea laxa Verrill.

Fig. 4–6. Spicules from lower lip.
Fig. 7–8. Short rods from inner layer of coenenchyma.

Muricea spicifera Lamouroux.

Fig. 9–10. Spicules from lower lip.
Fig. 11. Spicule from inner layer.

Muricea pendula Verrill.

Fig. 12. Spicule from lower lip.
Fig. 13–14. Spicules from inner layer of coenenchyma.

Large magnification; scale represents 0.01 mm.

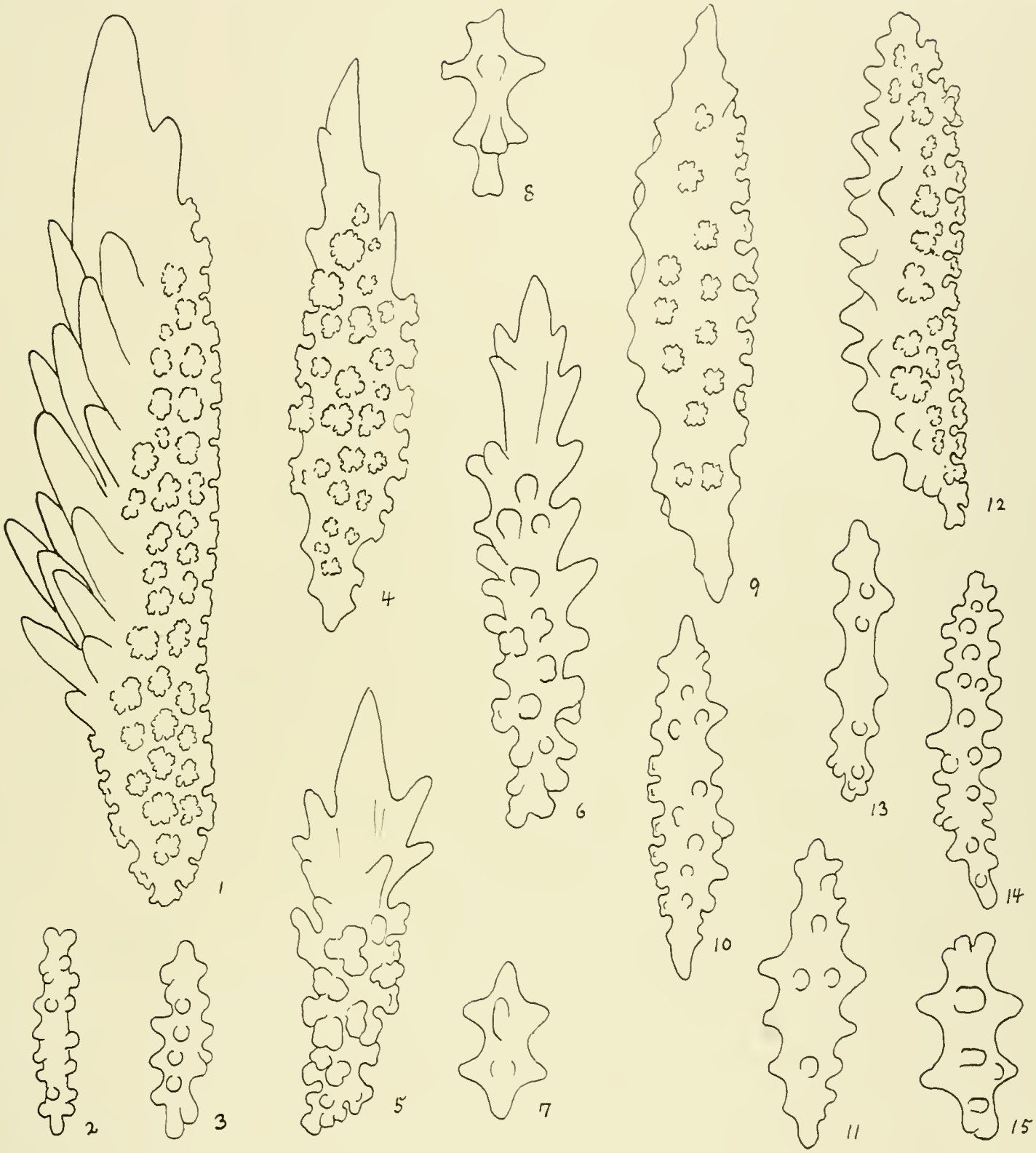
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PLATE 10

PLATE 10

MURICEIDAE

Bebryce cinerea sp. nov.
Fig. 1–8. Spicules from bodywall.

Bebryce grandis sp. nov.
Fig. 9–21. Spicules from bodywall.

Bebryce parastellata sp. nov.
Fig. 22–28. Spicules from bodywall.

Large magnification; scale represents 0.01 mm.

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PLATE 11

PLATE 11

MURICEIDAE

Thesea solitaria (Pourtalès).

Fig. 1–2. Spicules from bodywall.
Fig. 3. Spicule from tentacle.

Thesea grandiflora sp. nov., var. *rugulosa* var. nov.

Fig. 4–6. Spicules from bodywall.
Fig. 7. Spicule from tentacle.

Thesea rubra sp. nov.

Fig. 8–10. Spicules from bodywall.

Thesea bicolor sp. nov.

Fig. 11–13. Spicules from bodywall.

Thesea guadalupensis (Duchassaing & Michelotti).

Fig. 14–15. Spicules from bodywall.

Thesea nivea sp. nov.

Fig. 16–18. Spicules from bodywall.

Thesea hebes sp. nov.

Fig. 19–21. Spicules from bodywall.

Thesea parviflora sp. nov.

Fig. 22. Spicule from tentacle.
Fig. 23. Spicule from bodywall.

Thesea granulosa sp. nov.

Fig. 24. Spicule from tentacle.
Fig. 25–26. Spicules from bodywall.

Large magnification; scale represents 0.01 mm.

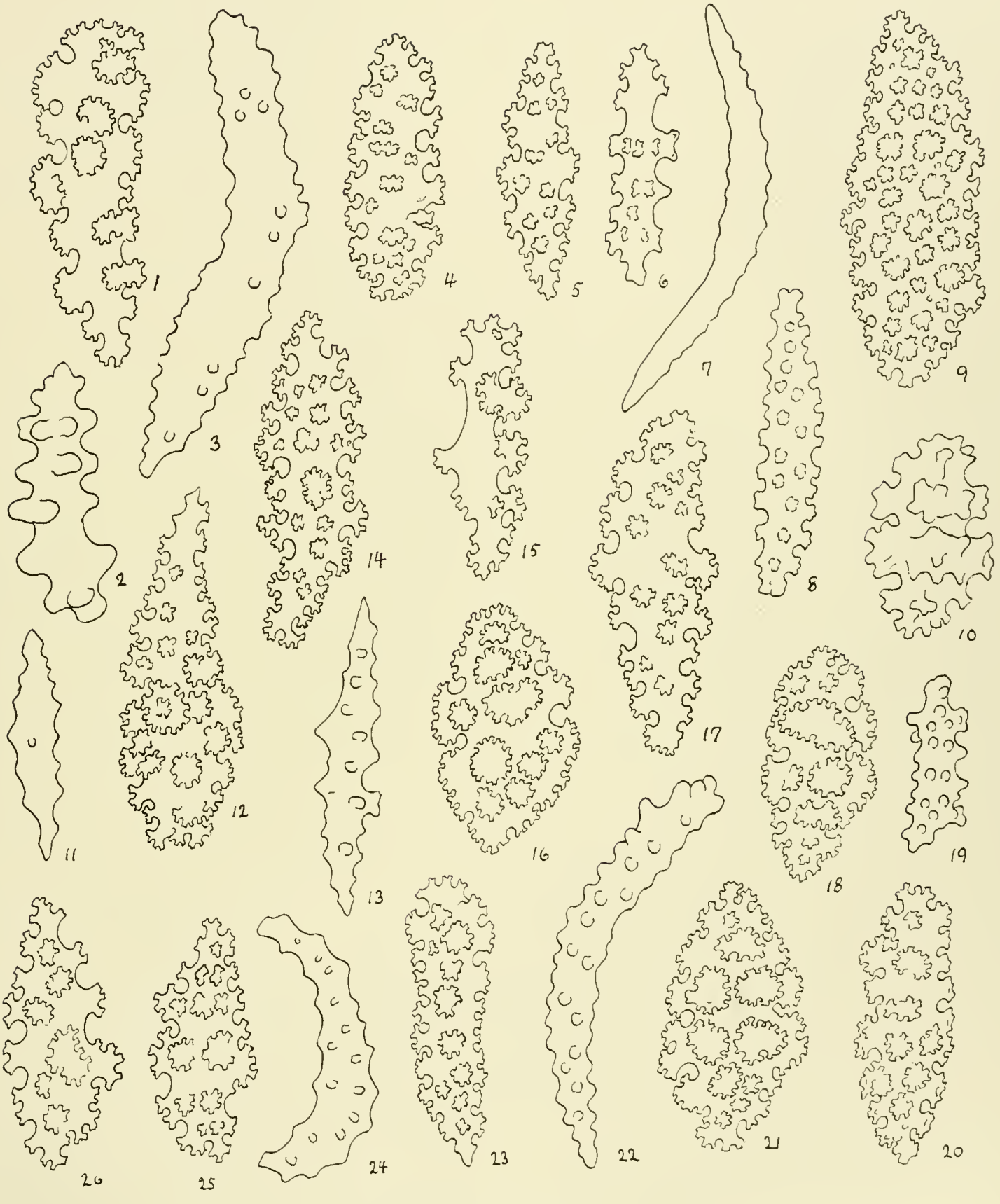
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PLATE 12

PLATE 12

MURICEIDAE

Thesea citrina sp. nov.

Fig. 1–3. Spicules from bodywall.

Thesea gracilis sp. nov.

Fig. 4–5. Spicules from bodywall.
Fig. 6. Spicules from operculum.
Fig. 7–8. Spicules from tentacles.

Placogorgia mirabilis sp. nov.

Fig. 9–10. Spicules from bodywall.
Fig. 11–12. Spicules from calicles.

Thesea sp.

Fig. 13. Spindle from bodywall.
Fig. 14. Spindle from collaret.
Fig. 15. Biborned deposit from the outer layer of the coenenchyma.

Echinomuricea atlantica (Johnson).

Fig. 16–19. Marginal scales from zooids.
Fig. 20–21. Warty rods from coenenchyma.
Fig. 22. Spindles from collaret.

Hypnogorgia pendula Duchassaing & Michelotti.

Fig. 23–24. Rods from operculum.

Low magnification; scale represents 0.05 mm.

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PLATE 13

PLATE 13

MURICEIDAE

Eubrandella flabellum (Verrill).

Fig. 1–13. Spicules, from bodywall and calicles.
Fig. 14–15. Spicules, from operculum.

Acanthacis austera sp. nov.

Fig. 16-17. Marginal thorn-scales.
Fig. 18. Spicule from operculum.
Fig. 19–20. Warty plates, from bodywall.

Acanthacis scabra sp. nov.

Fig. 21. Spicule from operculum.
Fig. 22–23. Marginal thornscales; in 22 the thorn is broken.
Fig. 24–25. Warty spindles, from bodywall.

Trachymuricea hirta (Pourtalès).

Fig. 26, 32-33. Simple spindle, from bodywall.
Fig. 27–31. Rods with outer projection, from bodywall and calicles.

Low magnification; scale represents 0.05 mm.

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PLATE 14

PLATE 14

MURICEIDAE

Paramuricea placomus (Linnaeus).

Fig. 1–2. Thornscale.
Fig. 3–8. Plates, crosses and kneebent rods.

Paramuricea placomus (Linnaeus); from off the coast of Norway.

Fig. 9–11. Crosses, spindles.
Fig. 12–13. Thornscales.

Paramuricea grandis Verrill.

Fig. 14–15. Thornscales.
Fig. 16–21. Plates from coenenchyma.

Paramuricea echinata sp. nov.

Fig. 22 and 25. Plates with projecting spine, from coenenchyma.
Fig. 23 and 26. Simple plates from coenenchyma.
Fig. 27. Thornscale from calicle.
Fig. 24 and 28. Spindle from collaret.

Paramuricea multispina nov. sp.

Fig. 29–30, 43. Plates from coenenchyma.
Fig. 31, 33–34, 37, 42. Halfcrosses, and three-armed rods from coenenchyma.
Fig. 32, 35–36, 39. Thornscales from calicles.
Fig. 38, 40-41. Plates with projecting low, rounded spire, from coenenchyma.

Low magnification; scale represents 0.05 mm.

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PLATE 15

PLATE 15

MURICEIDAE

Villogorgia nigrescens Duchassaing & Michelotti; typical colony.

Fig. 1–2. Spicules from operculum.
Fig. 3–6. Spicules from calicles.
Fig. 7–9. Four-armed bodies with central projection, from bodywall.

Villogorgia nigrescens Duchassaing & Michelotti; large colony.

Fig. 10–12. Spicules from calicles.
Fig. 14–15. Four-armed bodies with central projection, from bodywall.
Fig. 16–18. Rods from operculum.

Placogorgia tenuis (Verrill); typical form.

Fig. 19–20. Spindles with projection, from bodywall.
Fig. 21–24. Thornscales from calicles.
Fig. 25. Spindle from operculum.
Fig. 26. Spindle from collaret.

Placogorgia tenuis (Verrill); large colony, not quite typical.

Fig. 27–29. Thornscales from calicles.
Fig. 30–31. Spindles from operculum.
Fig. 32. Spindle from collaret.

Placogorgia rudis sp. nov.

Fig. 33. Thornscale from calicle.
Fig. 34. Warty spindle from bodywall.

Low magnification; scale represents 0.05 mm.

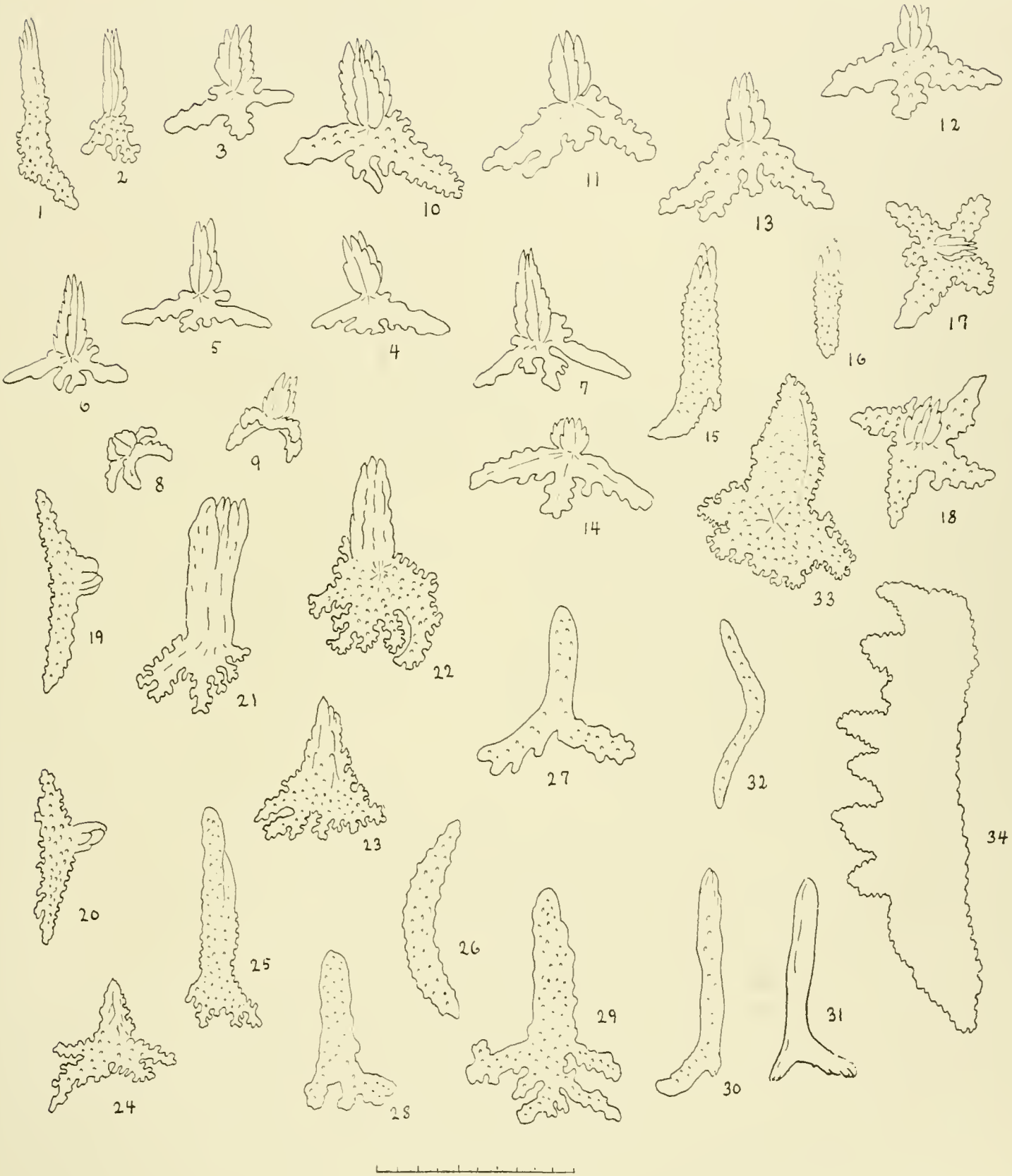
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PLATE 16

PLATE 16

ACANTHOGORGIIDAE

Acanthogorgia armata Verrill.

Fig. 1–2. Rods from the bodywall.
Fig. 3–4. Spinous rods from the margin of the calicles.

Acanthogorgia schrammi (Duchassaing & Michelotti).

Fig. 5–10. Spicules from the bodywall.
Fig. 11. Spinous rod from the wall of the calicles.
Fig. 12–13. Pointed rod from the margin of the calicle.

Acanthogorgia aspera Pourtalès.

Fig. 14–16. Warty rods from bodywall.
Fig. 17 and 20–22. Pointed smooth rods from margin of calicles.
Fig. 18–19. Rods from wall of calicles.
Fig. 23–27. Abnormal spicules; possibly from the type.

Low magnification; scale represents 0.05 mm.

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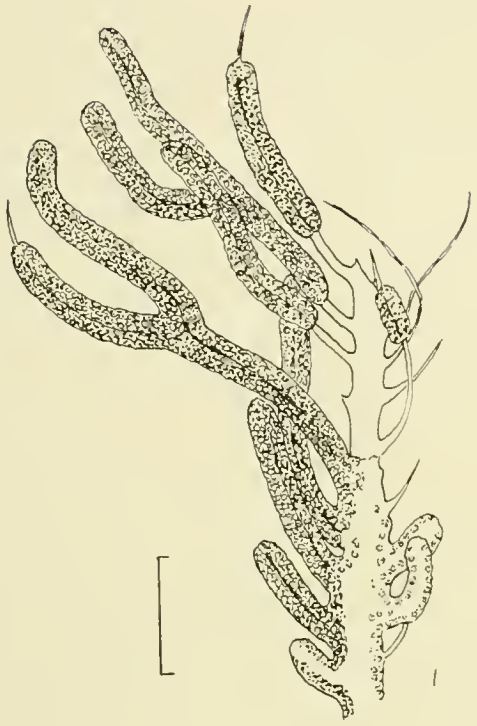
PLATE 17

PLATE 17

GORGONIIDAE

Fig. 1–2. *Leptogorgia sanguinolenta* (Pallas); dark and pale specimen.
Fig. 3. *Leptogorgia hebes* Verrill.
Fig. 4. *Leptogorgia purpurea* (Pallas).
Fig. 5. *Leptogorgia* sp.

Scale represents 1 cm.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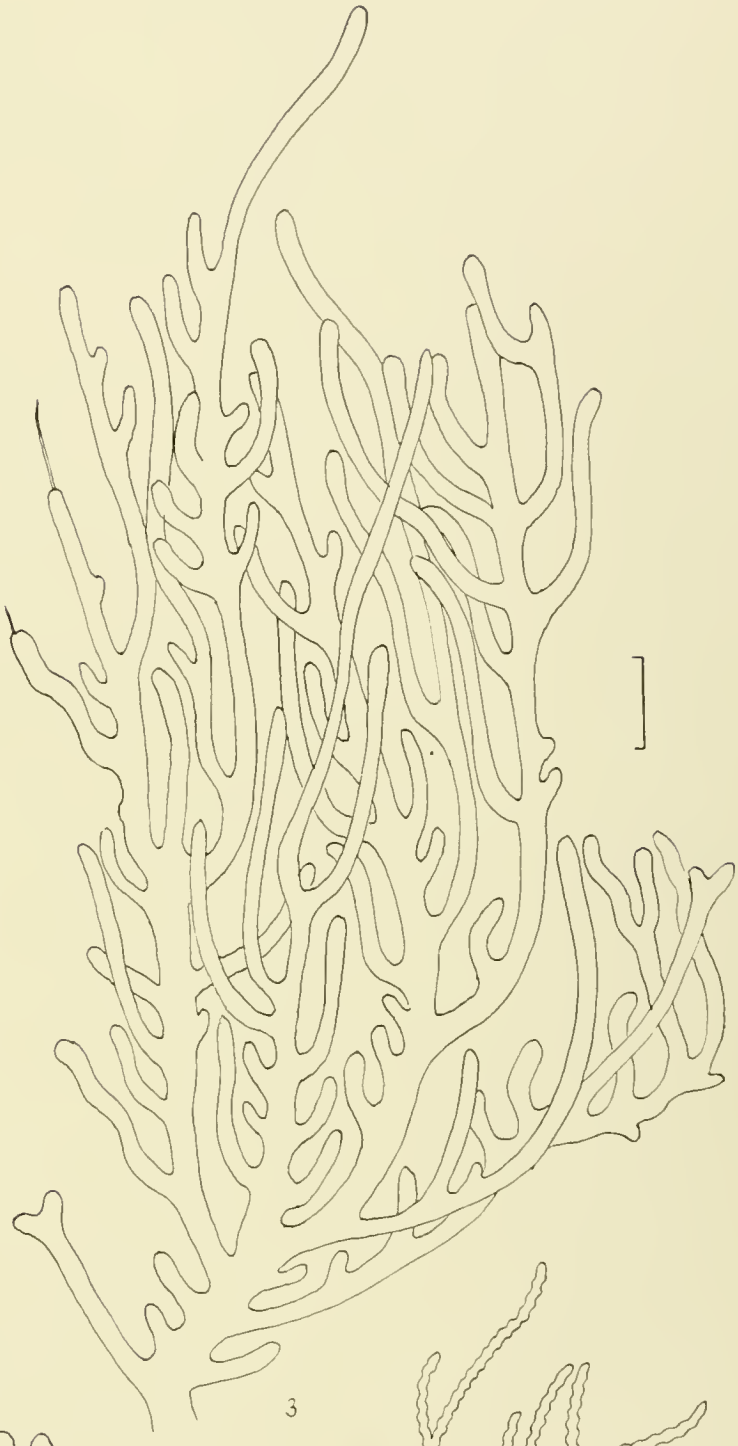
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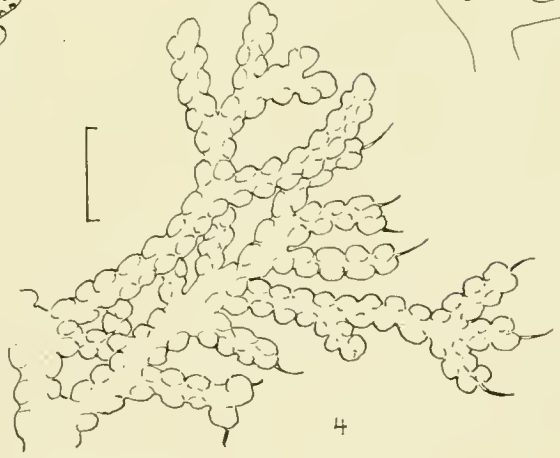
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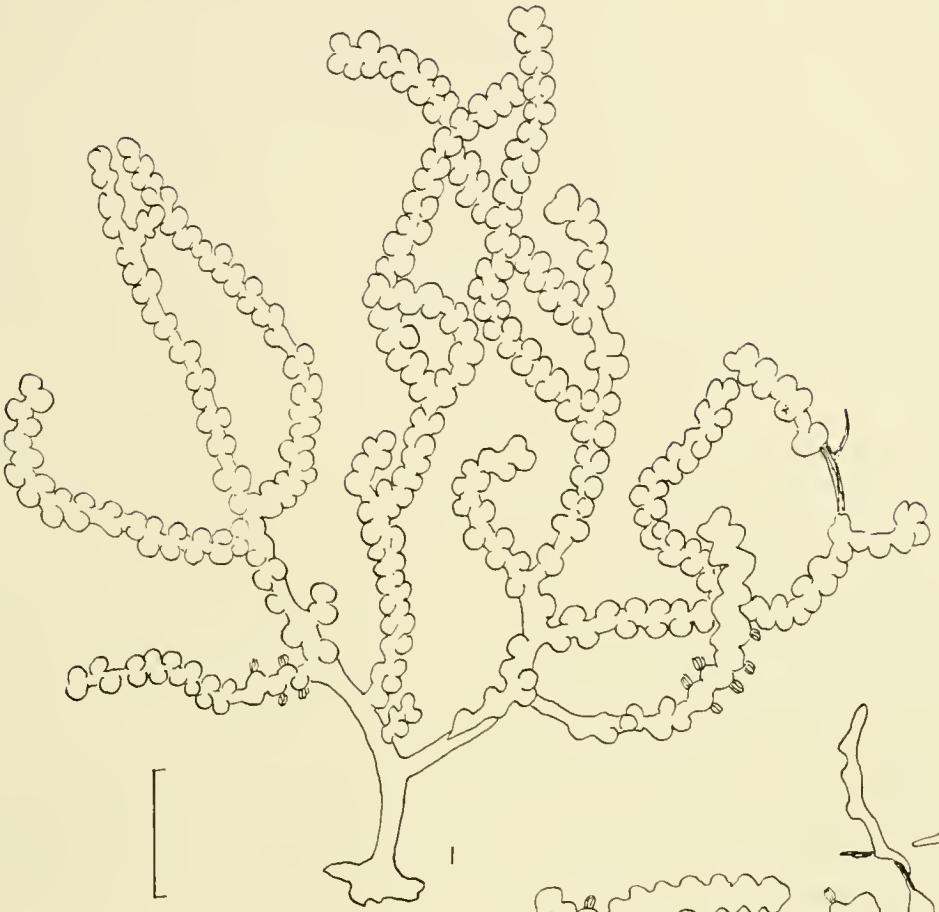
PLATE 18

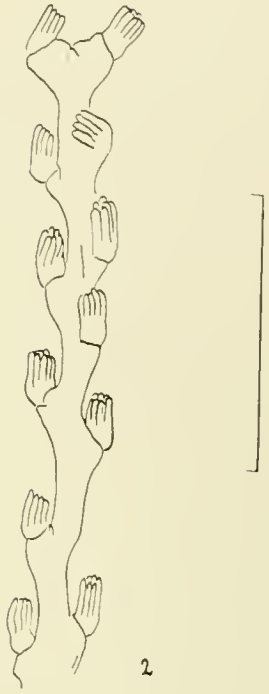
PLATE 18

GORGONIIDAE

Fig. 1. *Swiftia casta* (Verrill).
Fig. 2. *Swiftia* sp.
Fig. 3. *Swiftia koreni* (Studer).
Fig. 4. *Swiftia pourtalesii* nom. nov.

Scale represents 1 cm.





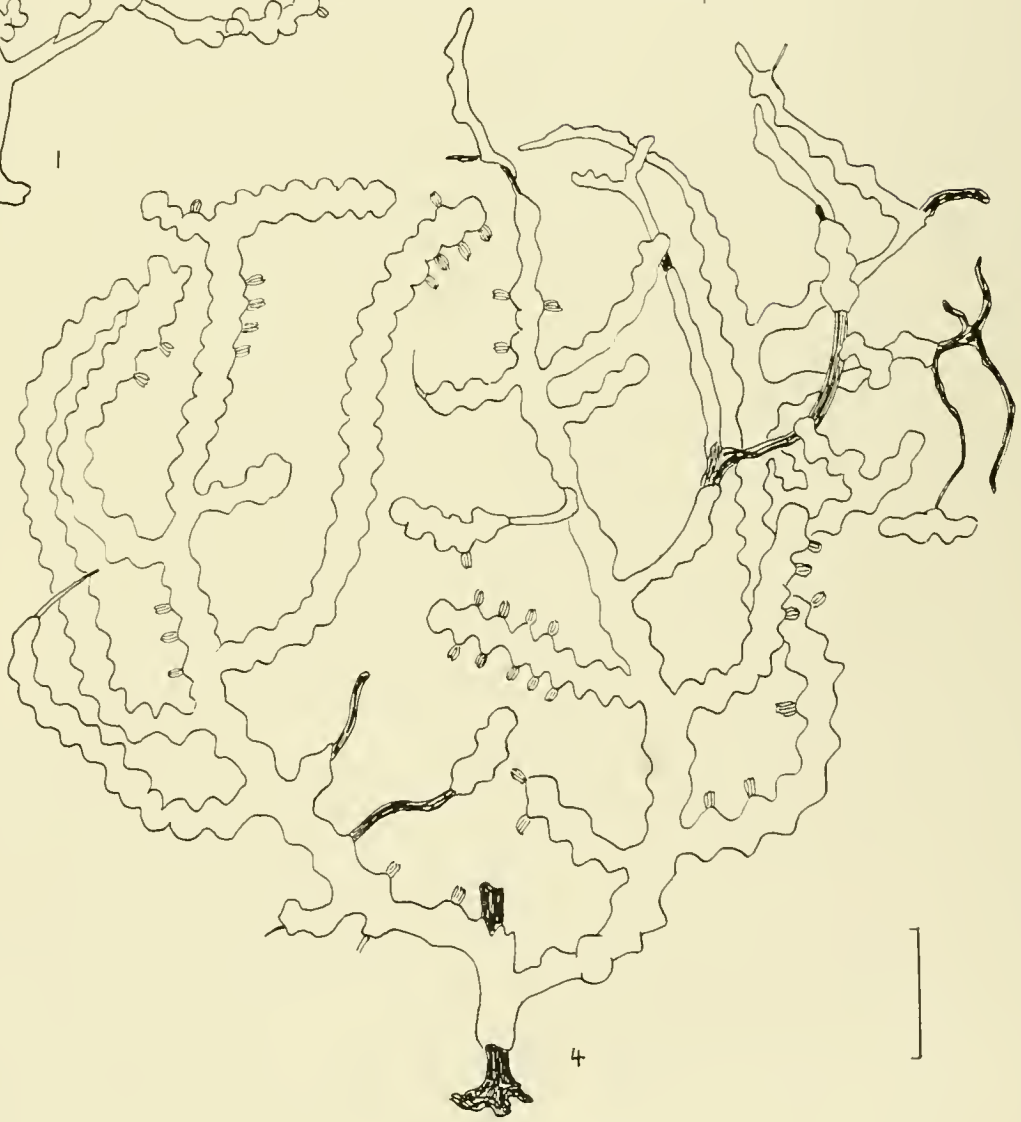


PLATE 19

PLATE 19

GORGONIIDAE

Leptogorgia miniata (Valenciennes); specimen received from Kölliker.

Fig. 1–4. Spicules from the bodywall.
Fig. 5–7. Spicules from tentacles.

Leptogorgia purpurea (Pallas).

Fig. 8–15. Spicules from bodywall.

Leptogorgia hebes Verrill; from Beaufort, N. C.

Fig. 16–23. Spicules from the bodywall.

Leptogorgia virgulata (Lamarck).

Fig. 24–34. Spicules from bodywall.

Leptogorgia setacea (Pallas); from Bahamas.

Fig. 35–38. Spicules from bodywall.

Leptogorgia sanguinolenta (Pallas).

Fig. 39–40. Spicules from bodywall.

Leptogorgia sp.

Fig. 41–42. Spicules from bodywall.
Fig. 43. Spicule from zooid.

Large magnification; scale represents 0.01 mm.

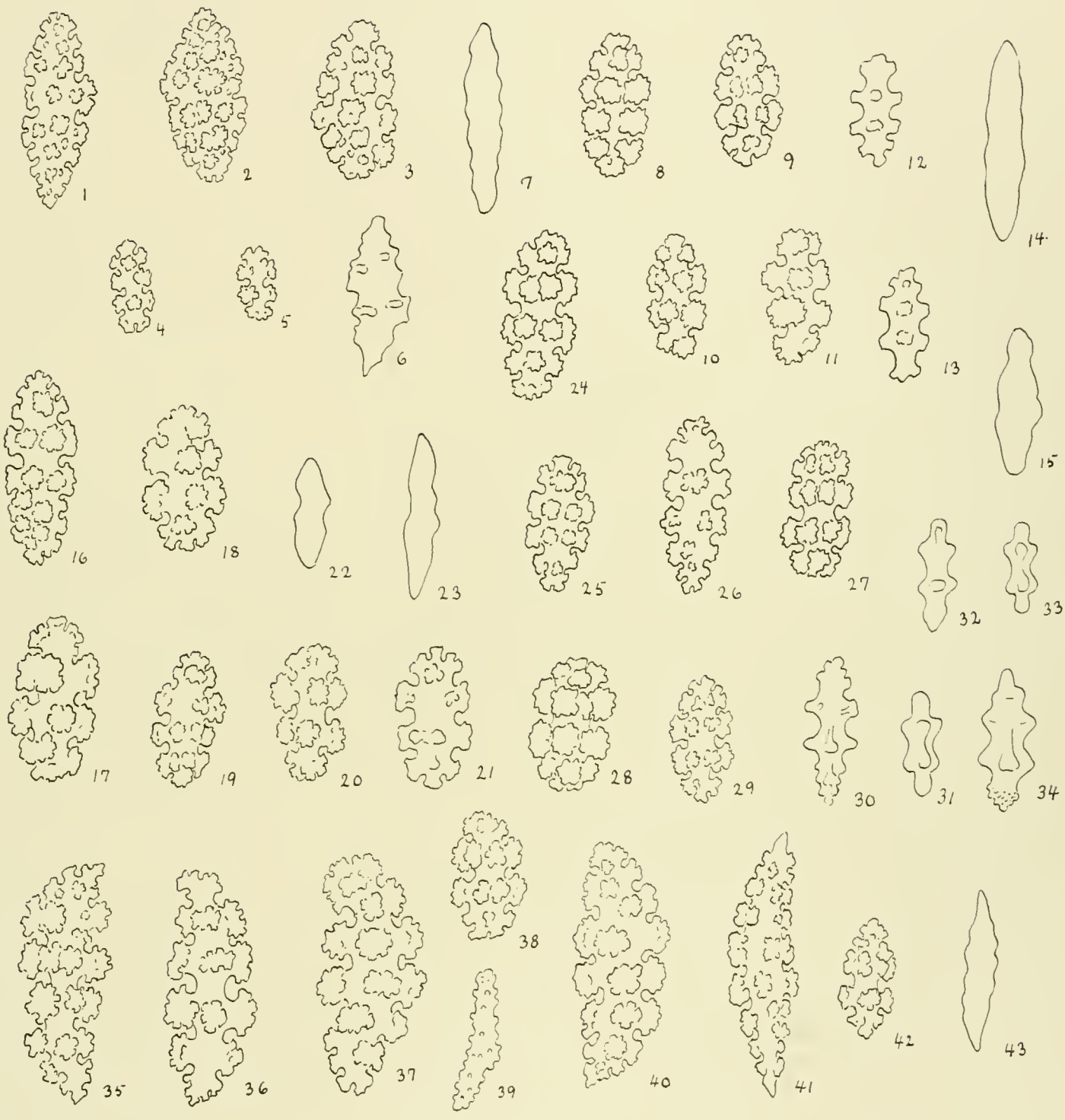

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PLATE 20

PLATE 20

GORGONIIDAE

Swiftia casta (Verrill); type.

Fig. 1–4. Spicules from bodywall.
Fig. 5. Spicule from tentacle.

Swiftia pourtalesii nom. nov.

Fig. 6–9. Spicules from bodywall.
Fig. 10. Spicule from tentacle.

Swiftia koreni (Studer).

Fig. 11–16. Spicules from bodywall.
Fig. 17. Spicule from tentacle.

Swiftia exserta (Ellis & Solander).

Fig. 18–23. Spicules from the bodywall.

Swiftia sp.

Fig. 24–28. Spicules from the bodywall.

Large magnification; scale represents 0.01 mm.

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PLATE 21

PLATE 21

GORGONIIDAE

Pterogorgia bipinnata Verrill; specimen from Barbados.

Fig. 1–5. Scaphoids from outer layer of coenenchyma.
Fig. 6–7. Spindles from inner layer of coenenchyma.
Fig. 8. Flat rod from tentacles.

Pterogorgia bipinnata Verrill; type.

Fig. 9–13. Scaphoids from outer layer of coenenchyma.
Fig. 14–15. Spindles from inner layer of coenenchyma.
Fig. 16. Flat rod from tentacles.

Pterogorgia acerosa (Pallas); typical form.

Fig. 17–18. Spindles from inner layer of coenenchyma.
Fig. 19–20. Scaphoids from outer layer of coenenchyma.

Pterogorgia ellisiana Milne-Edwards.

Fig. 21–23. Scaphoids from outer layer of coenenchyma.
Fig. 24. Spindle from inner layer of coenenchyma.

Rhipidogorgia flabellum (Linnaeus).

Fig. 25–28. Scaphoids from coenenchyma.

Pterogorgia americana (Gmelin).

Fig. 29–30. Scaphoids from outer layer of coenenchyma.
Fig. 31–32. Spindles from inner layer of coenenchyma.

Large magnification; scale represents 0.01 mm.

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PLATE 22

PLATE 22

CHRYSOGORGIIDAE

Trichogorgia viola sp. nov.

Fig. 1–3. Three fragments of colonies.

Metallogorgia splendens (Verrill).

Fig. 4. Fragment of branch with a few zooids.

Chrysogorgia desbonni Duchassaing & Michelotti.

Fig. 5. Branch of colony with several zooids.

Chrysogorgia fewkesi Verrill var. *multiflora* n. var.

Fig. 6. Branch of colony with the typical arrangement of the zooids.

Chrysogorgia elegans (Verrill).

Fig. 7. Branch of colony with the typical arrangement of the zooids.

Chrysogorgia squamata (Verrill).

Fig. 8. Branch of colony with the typical arrangement of the zooids.

Riisea paniculata Duchassaing & Michelotti.

Fig. 9. Branch of colony with the typical arrangement of the zooids.

Scale represents 1 cm.

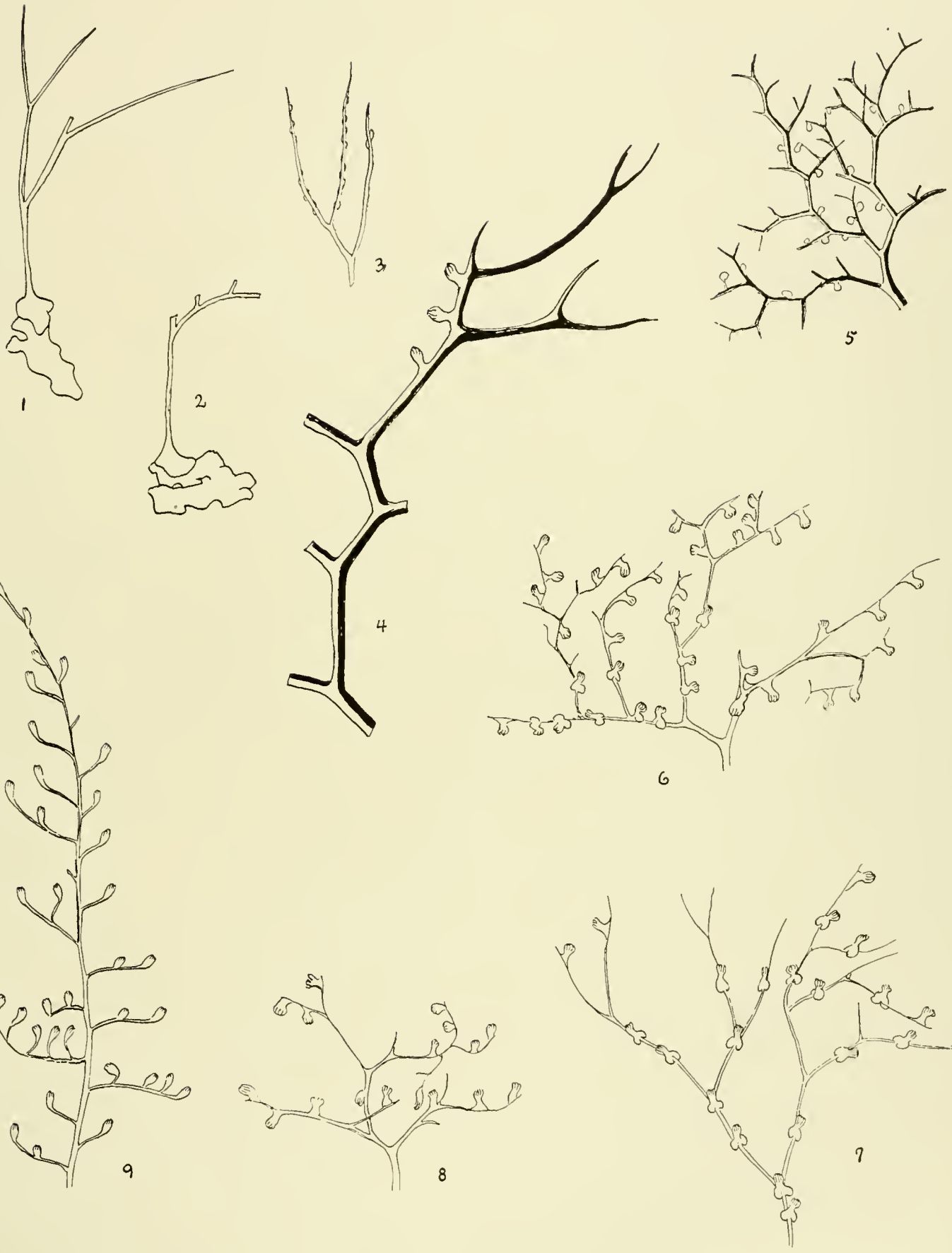
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PLATE 23

PLATE 23

CHRYSOGORGIIDAE

Trichogorgia viola sp. nov.

Fig. 1. Plates from the coenenchyma.

Metallogorgia splendens (Verrill).

Fig. 2–7. Plates from the coenenchyma.

Riisea paniculata Duchassaing & Michelotti.

Fig. 8–18. Plates and double heads from coenenchyma.

Chrysogorgia desbonni Duchassaing & Michelotti.

Fig. 19–27. Rods and plates from integument and tentacles.

Chrysogorgia squamata (Verrill).

Fig. 28–33. Plates from the coenenchyma.

Chrysogorgia agassizii (Verrill).

Fig. 34–40. Plates from the coenenchyma.

Chrysogorgia fewkesi Verrill.

Fig. 41–50. Curved rods from zooids, and warted rods from the coenenchyma.

Chrysogorgia fewkesi Verrill var. *multiflora* var. nov.

Fig. 51–52. Curved rods from zooids.

Chrysogorgia elegans (Verrill).

Fig. 53–59. Rods from coenenchyma.

Iridogorgia pourtalesii Verrill.

Fig. 60–64. Rods from coenenchyma.

Low magnification; scale represents 0.05 mm, except no. 8–18 which are drawn at high magnification; scale represents 0.01 mm.

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PLATE 24

PLATE 24

GORGONELLIDAE

Scirpearia barbadensis (Duchassaing & Michelotti).

Fig. 1–19. Double rods and double heads from various colonies, showing the wide range of variation.

Scirpearia atlantica Toeplitz (= *ochracea* Toeplitz).

Fig. 20–28a. Double rods and double heads and capstans from various colonies.

Scirpearia funiculina (Duchassaing & Michelotti).

Fig. 29–36. Double rods, double heads and capstans.

Scirpearia grandiflora sp. nov.

Fig. 37–41. Double rods and double heads and capstans.

Scirpearia grandis (Verrill).

Fig. 42–45. Double heads, capstan and double rod.

Scirpearia elongata (Pallas).

Fig. 46–48. Capstans, double head and double rod.

Large magnification; scale represents 0.01 mm.

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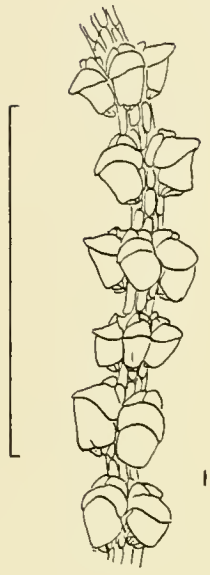
PLATE 25

PLATE 25

PRIMNOIDAE

Fig. 1. *Calyptrophora trilepis* (Pourtalès); branch of type.
Fig. 2. *Thouarella goësi* (Aurivillius); an entire colony except the base and the tip of the branchlet.
Fig. 3. *Narella pauciflora* sp. nov.; branch of colony.
Fig. 4. *Caligorgia gracilis* (Milne-Edwards); part of branchlet.
Fig. 5. *Caligorgia verticillata* (Pallas); part of branchlet.
Fig. 6–9. *Caligorgia verticillata* (Pallas); opercular scale and calicinal scales.
Fig. 10–11. *Caligorgia gracilis* (Milne-Edwards); opercular scale and calicinal scale.
Fig. 12–13. *Thouarella aurea* sp. nov.; opercular scale and calicinal scale.
Fig. 14–16. *Plumarella pourtalesii* (Verrill) var. *robusta* n. var.; opercular scale and calicinal scale.
Fig. 17–18. *Plumarella pourtalesii* (Verrill); opercular scale and calicinal scale.
Fig. 19–23. *Thouarella goësi* (Aurivillius); opercular scale, calicinal scales, and coenenchyma scale.

Figures 1–5 are magnified; the scale represents 1 cm. Figures 6–23 are drawn to same scale, low magnification; the scale below represents 0.05 mm.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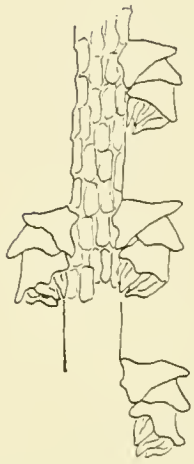
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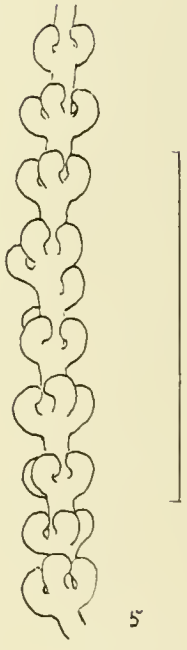
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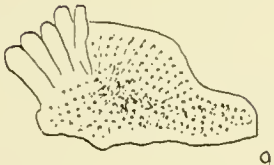
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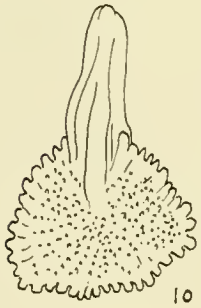
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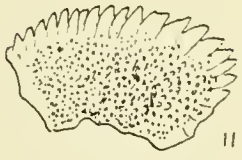
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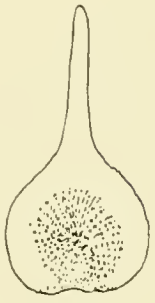
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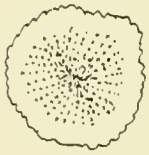
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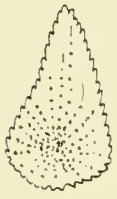
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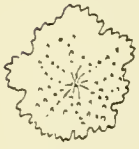
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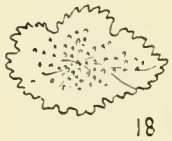
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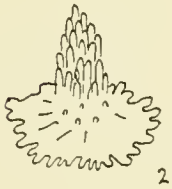
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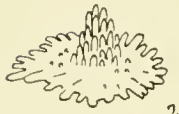
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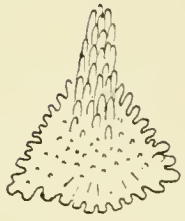
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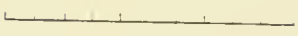

PLATE 26

PLATE 26

PRIMNOIDAE

Fig. 1. *Narella laxa*, sp. nov.
Fig. 2. *Narella pauciflora* sp. nov.
Fig. 3. *Narella regularis* (Duchassaing & Michelotti).
Fig. 4. *Calyptrophora trilepis* (Pourtales).
Fig. 5. *Stenella imbricata* (Johnson).
Fig. 6. *Caligorgia verticillata* (Pallas).
Fig. 7. *Caligorgia gracilis* (Milne-Edwards).
Fig. 8. *Thouarella goësi* (Aurivillius).
Fig. 9. *Plumarella pourtalesii* (Verrill) var. *robusta* n. var.
Fig. 10. *Plumarella pourtalesii* (Verrill); type.
Fig. 10a. *Plumarella pourtalesii* Verrill, from off Florida.
Fig. 11. *Thouarella aurea* sp. nov.
Fig. 12. *Primnoella polita* spec. nov. (*P. distans* Studer, partim).

The drawings are all made with binocular microscope and camera lucida; the scale represents 1 mm.

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PLATE 27

PLATE 27

Eunephthya nigra Pourtalès.

Fig. 1–2. Complete colonies.

Neospongodes portoricencis (Hargitt & Rogers).

Fig. 3–12. Complete colonies, of different age.

Neospongodes caribaea spec. nov.

Fig. 13. Branch.

All enlarged about twice.

A. H. VERRILL, PHOTO.

1.–2. EUNEPHTHYA NIGRA POURTALÈS
3.–12. NEOSPONGODES PORTORICENSIS (HARGITT AND ROGERS)
13. NEOSPONGODES CARIBAEA SPEC. NOV.

COCKAYNE, BOSTON

PLATE 28

PLATE 28

MURICEIDAE

Muricea laxa Verrill.

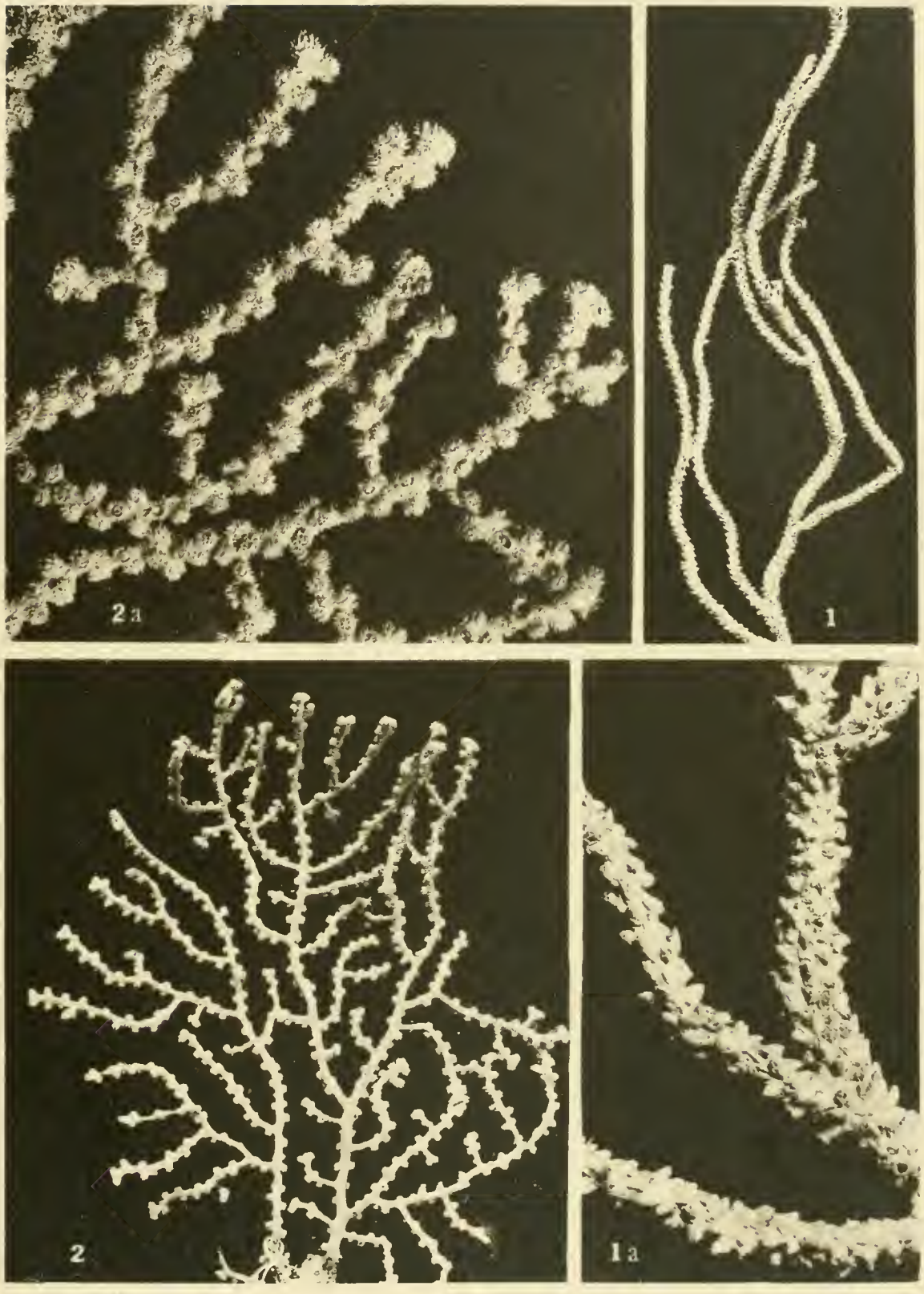
Fig. 1. Branches, about natural size.

Fig. 1a. Branches, enlarged.

Villogorgia nigrescens Duchassaing & Michelotti.

Fig. 2. Almost complete colony, natural size.

Fig. 2a. Branches, enlarged.



A. H. VERRILL, PHOTO.

1–1A. MURICEA LAXA VERRILL

2–2A. VILLOGORGIA NIGRESCENS DUCHASSAING AND MICHELOTTI

COCKAYNE, BOSTON

PLATE 29

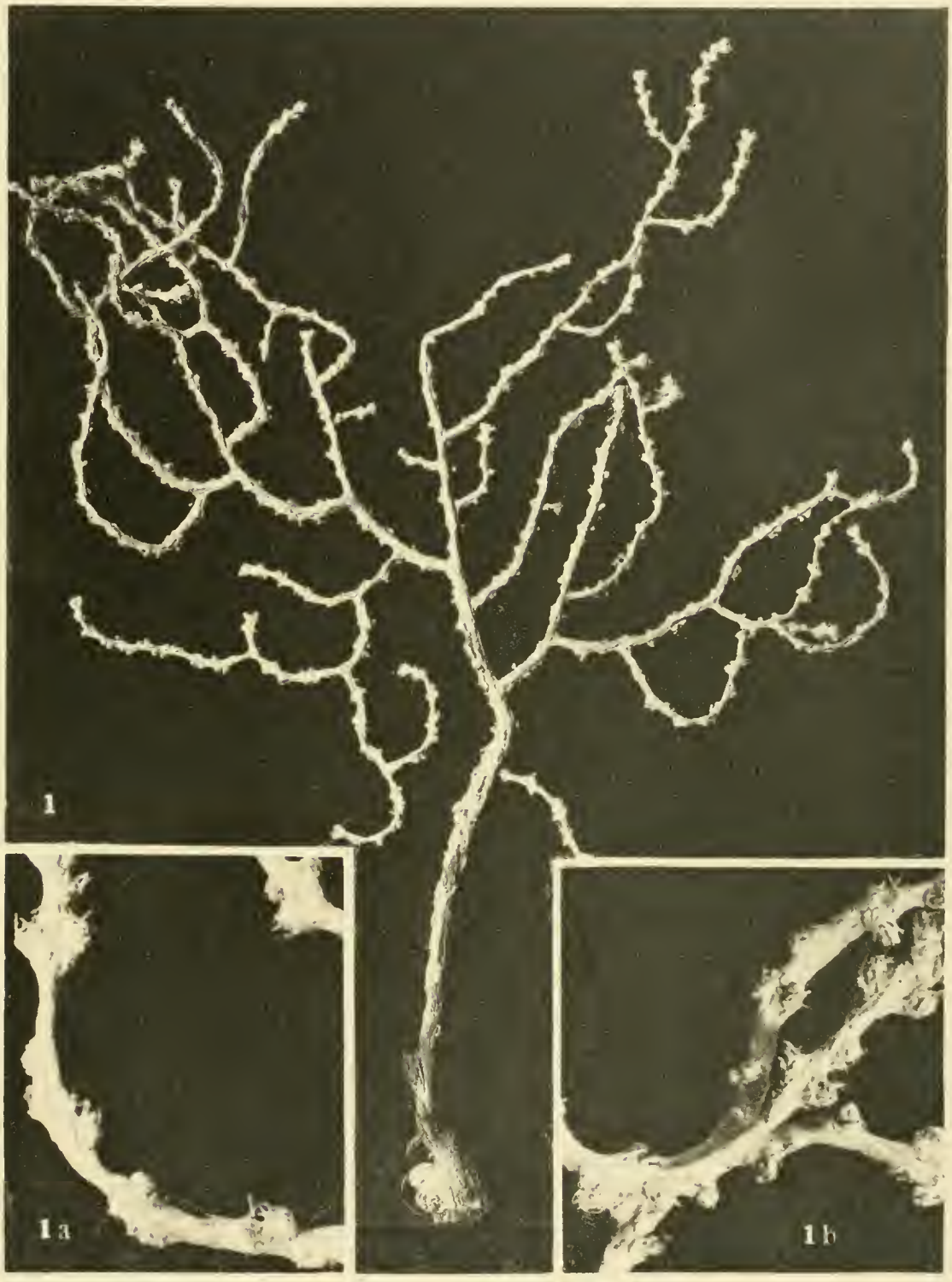
PLATE 29

MURICEIDAE

Acanthacis scabra spec. nov.

Fig. 1. Complete colony, natural size.

Fig. 1a–b. Part of branches, enlarged.



A. H. VERRILL, PHOTO.

ACANTHACIS SCABRA

COCKAYNE, BOSTON

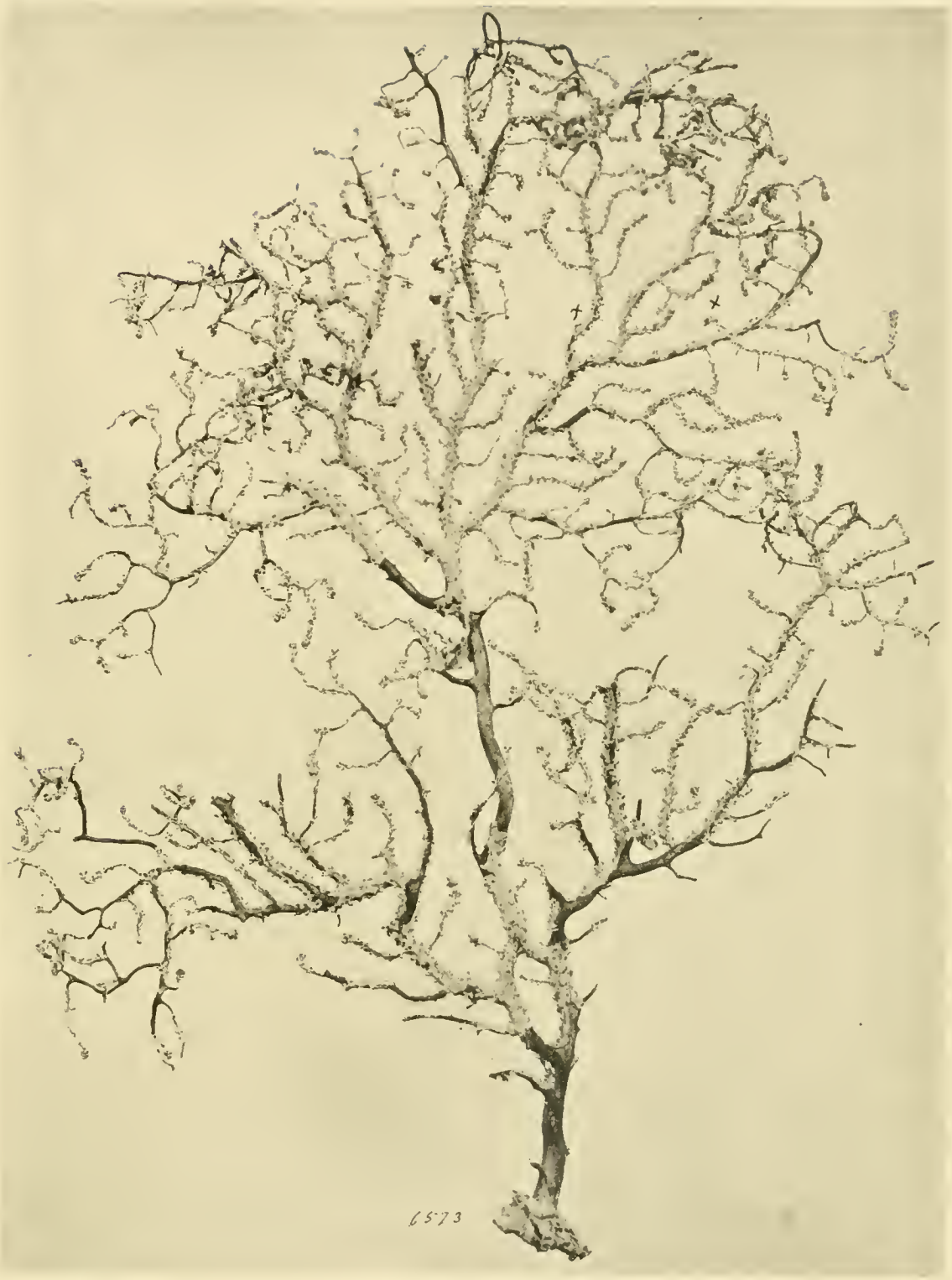
PLATE 30

PLATE 30

MURICEIDAE

Placogorgia tenuis (Verrill).

Complete colony, natural size.



A. H. VERRILL, PHOTO

PLACOGORGIA TENUIS (VERRILL)

COCKAYNE, BOSTON

PLATE 31

PLATE 31

ACANTHOGORGIIDAE

Acanthogorgia schrammi (Duchassaing & Michelotti).

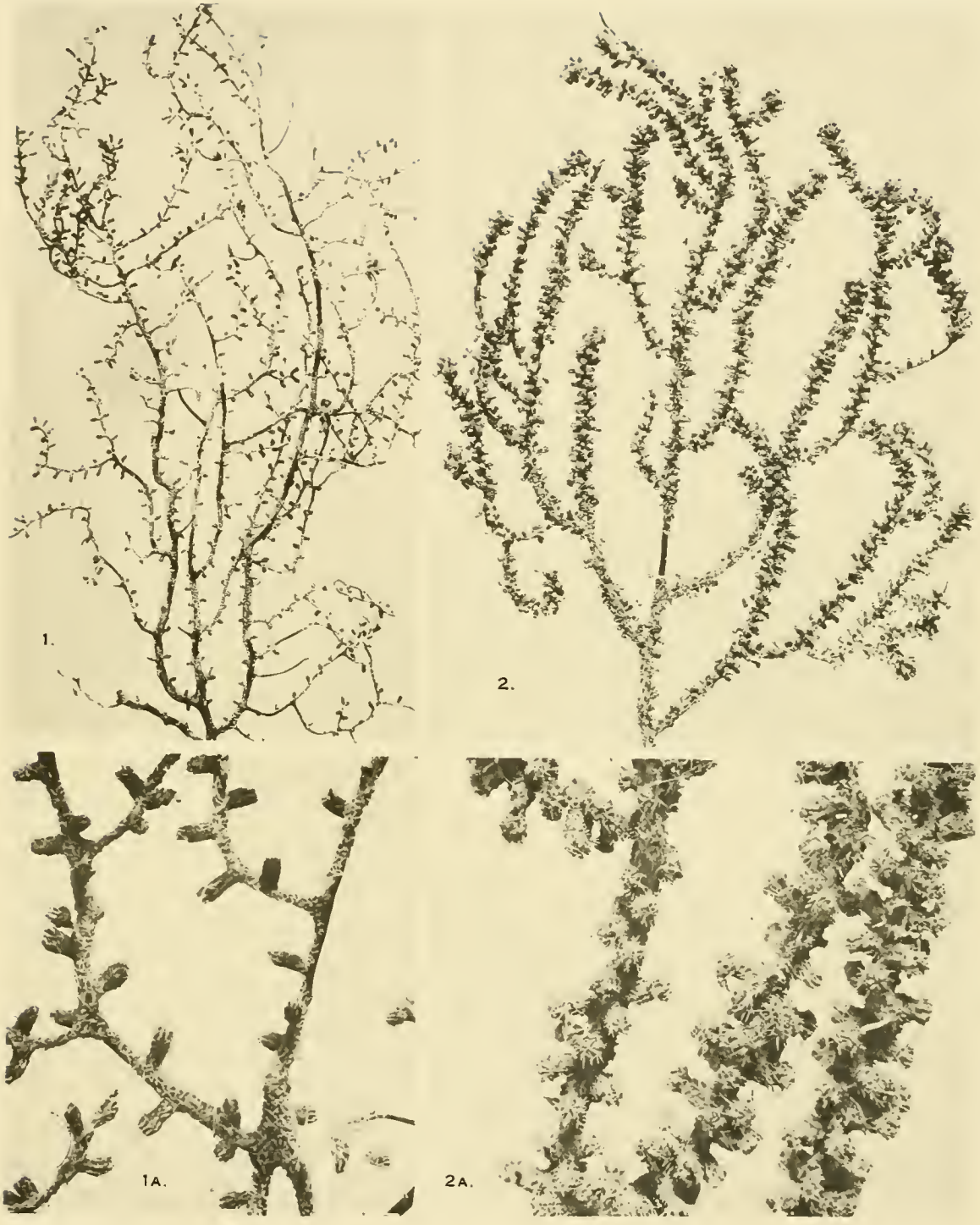
Fig. 1. Almost complete colony, natural size.

Fig. 1a. Branches, enlarged.

Acanthogorgia aspera Pourtalès.

Fig. 2. Almost complete colony.

Figure 2a. Branches, enlarged.



A. H. VERRILL, PHOTO.

1. ACANTHOGORGIA SCHRAMMI (DUCHASSAING AND MICHELOTTI)
2. ACANTHOGORGIA ASPERA POURTALÈS

COCKAYNE, BOSTON

PLATE 32

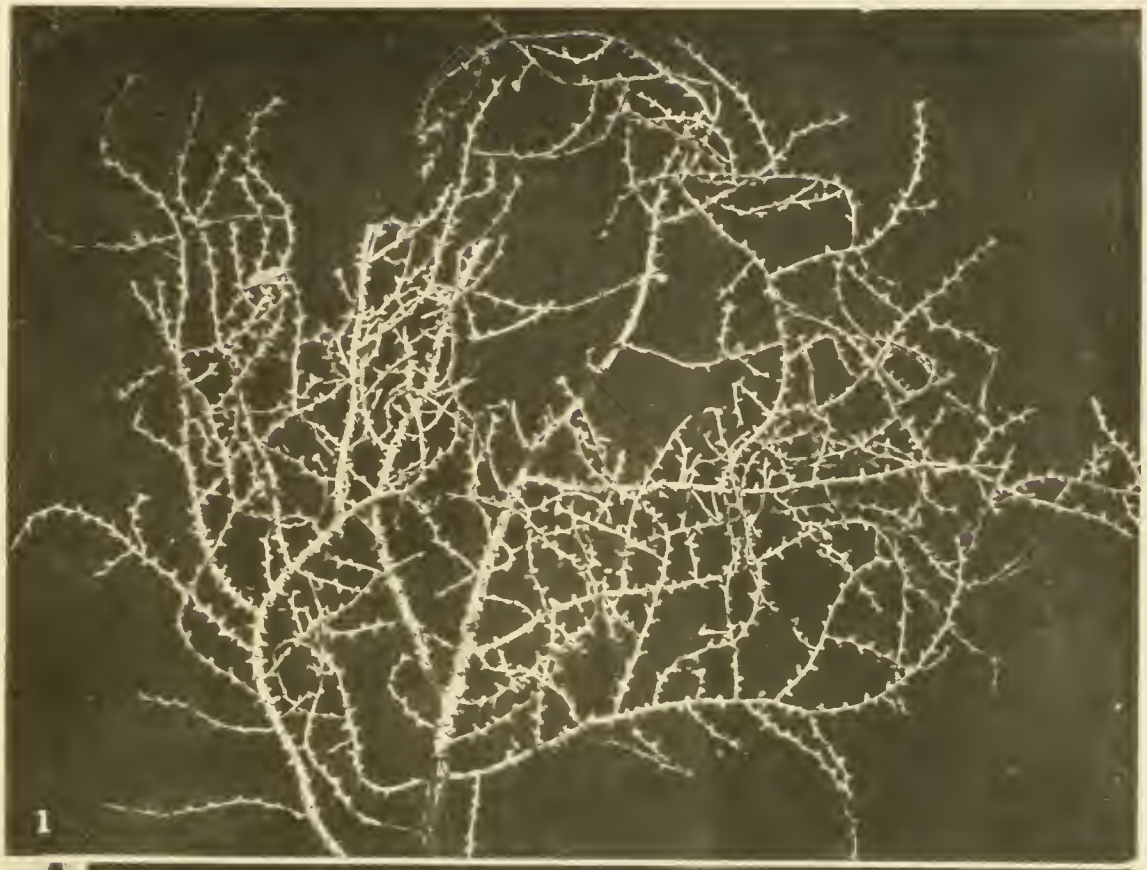
PLATE 32

GORGONIIDAE

Swiftia exserta (Ellis & Solander).

Fig. 1. Almost complete colony, less than natural size.

Fig. 1a. Branches, enlarged.



A. H. VERRILL, PHOTO.

SWIFTIA EXSERTA (ELLIS AND SOLANDER)

PLATE 33

PLATE 33

CHRYSOGORGIIDAE; MURICEIDAE

Chrysogorgia elegans Verrill.

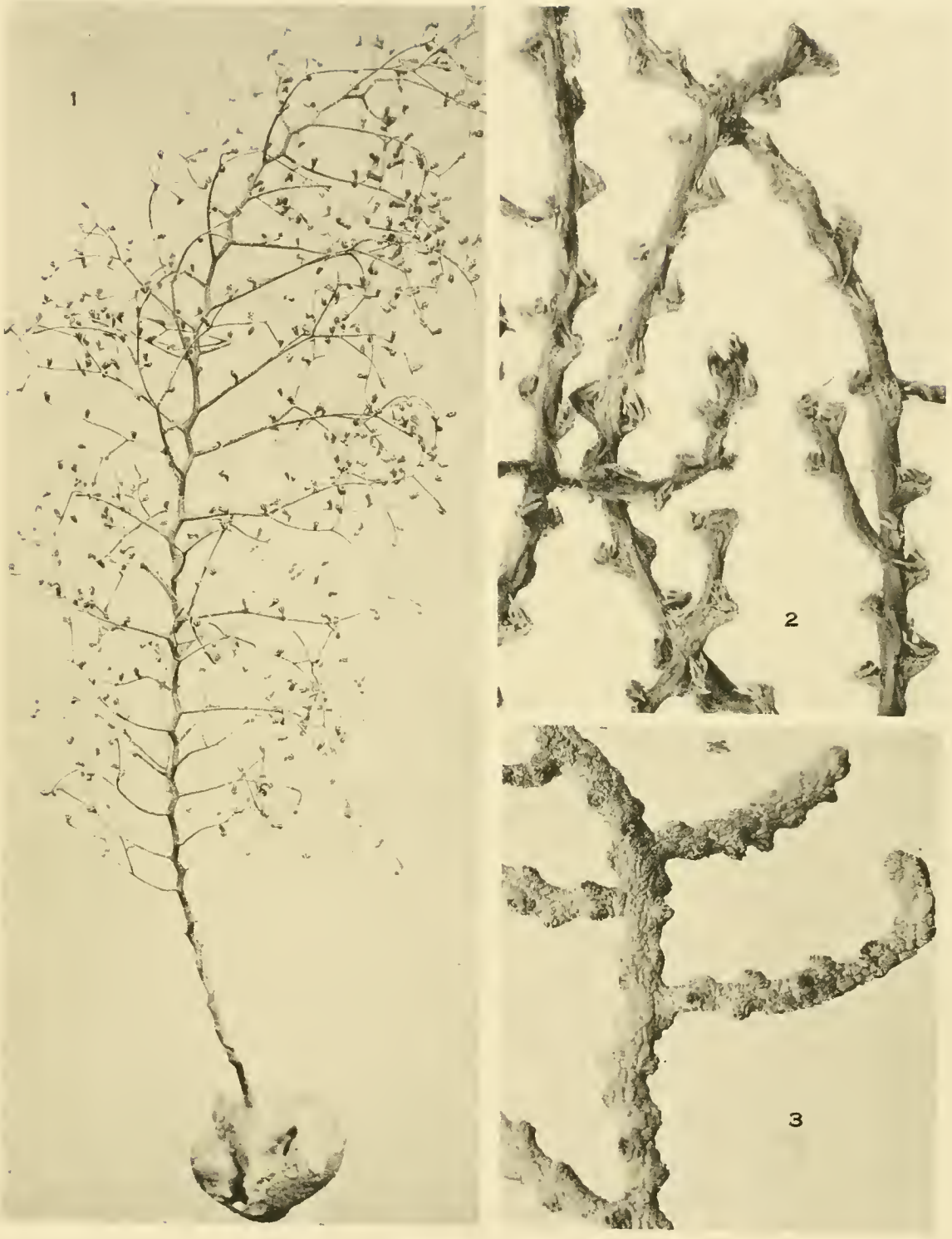
Fig. 1. Complete colony, natural size.

Hypnogorgia pendula Duchassaing & Michelotti.

Fig. 2. Branches, enlarged.

Thesea grandiflora spec. nov.

Fig. 3. Branches, enlarged.



A. H. VERRILL, PHOTO

1. CHRYSOGORGIA ELEGANS (VERRILL)
2. HYPNOGORGIA PENDULA DUCHASSAING AND MICHELOTTI
3. THESEA GRANDIFLORA SPEC. NOV.

COCKAYNE, BOSTON

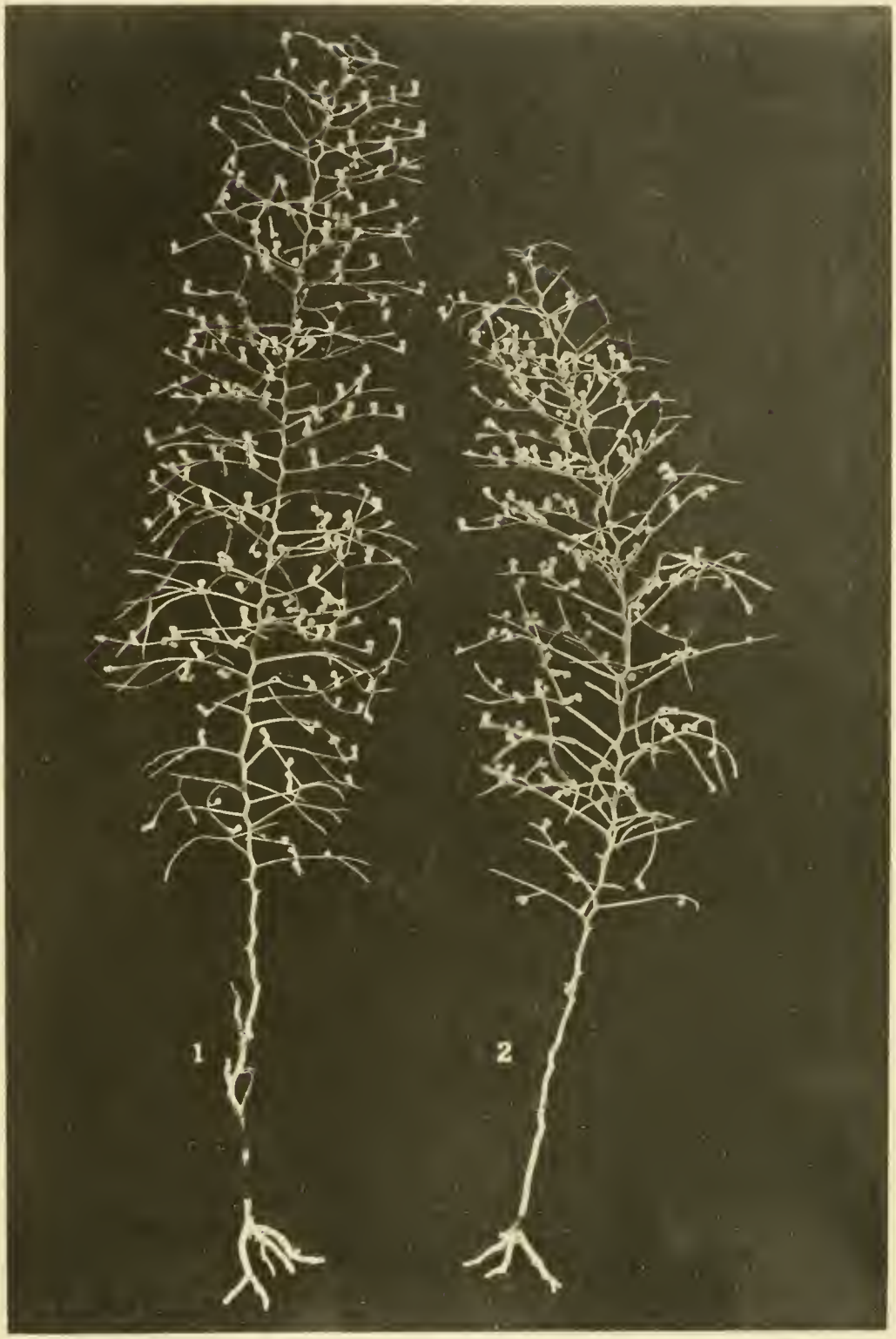
PLATE 34

PLATE 34

CHRYSOGORGIIDAE

Chrysogorgia agassizii Verrill.

Complete colonies, natural size.



A. H. VERRILL, PHOTO.

1–2. CHRYSOGORGIA AGASSIZII (VERRILL)

COCKAYNE, BOSTON

PLATE 35

PLATE 35

CHRYSOGORGIIDAE

Chrysogorgia desbonni Duchassaing & Michelotti.

Fig. 1. Almost complete colony, enlarged.

Riisea paniculata Duchassaing & Michelotti

Fig. 2. Branches, enlarged.

A. H. VERRILL, PHOTO.

1. CHRYSOGORGIA DESBONNI DUCHASSAING AND MICHELOTTI
2. RIISEA PANICULATA DUCHASSAING AND MICHELOTTI

COCKAYNE, BOSTON

PLATE 36

PLATE 36

GORGONELLIDAE

Nicella guadalupensis (Duchassaing & Michelotti).

Almost complete colony, less than natural size.

A. H. VERRILL, PHOTO.

NICELLA GUADALUPENSIS (DUCHASSAING AND MICHELOTTI)

COCKAYNE, BOSTON

PLATE 37

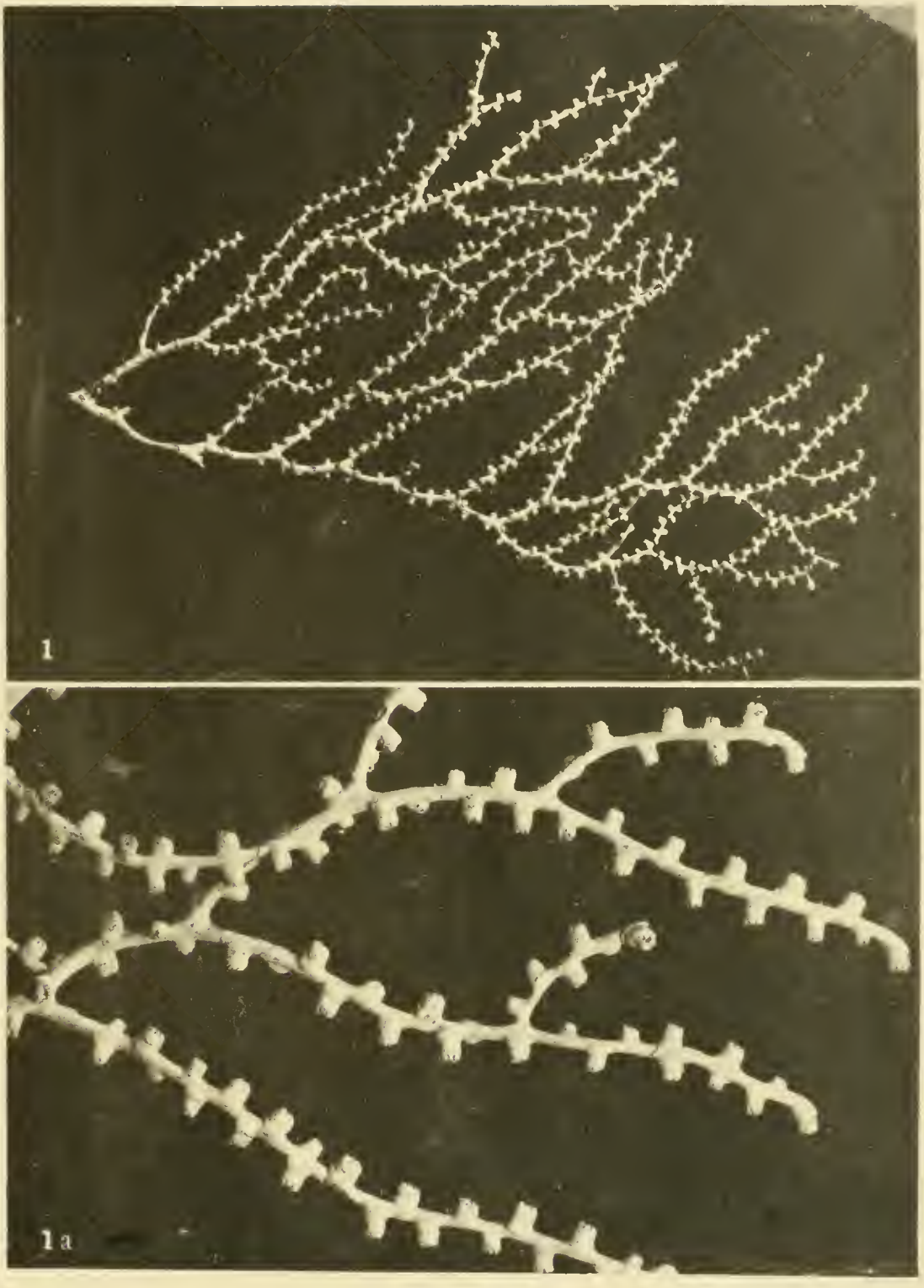
PLATE 37

GORGONELLIDAE

Nicella obesa spec. nov.

Fig. 1. Almost complete colony, natural size.

Fig. 1a. Branches, enlarged.



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1. NICELLA OBESA SPEC. NOV.

COCKAYNE, EDSTON

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